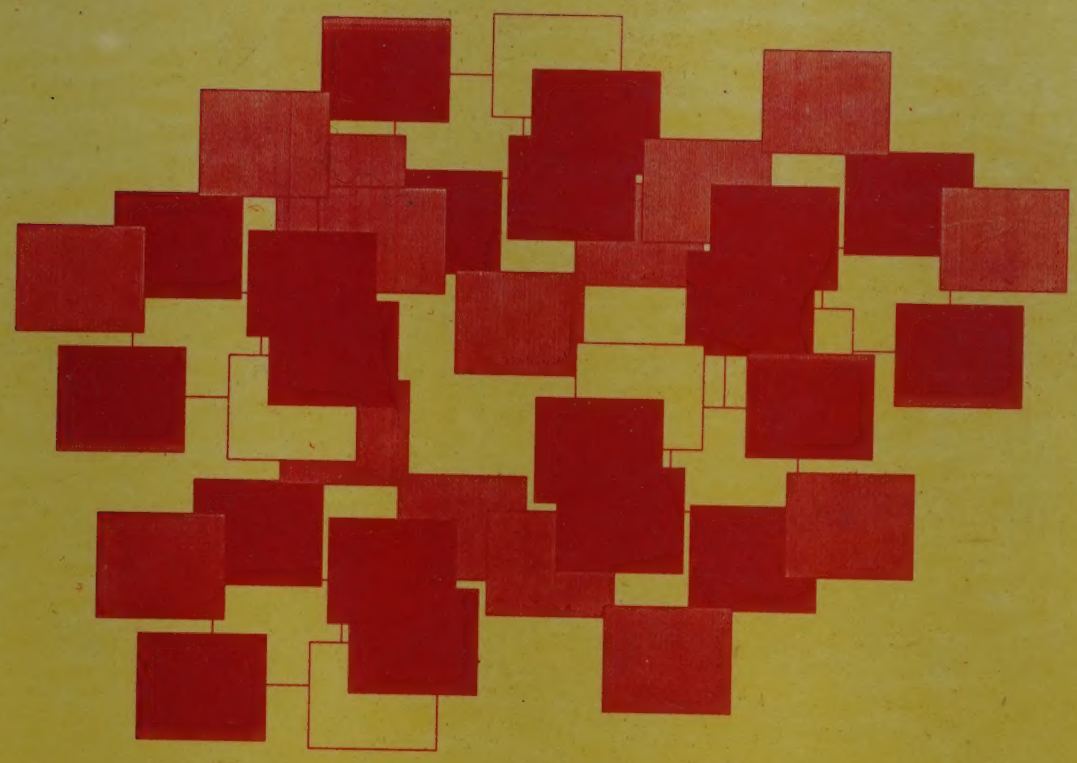

NATIONAL SEMINAR ON INDIAN SWEETS INDUSTRY

Development in Processing, Packaging & Marketing

BANGALORE, APRIL 30, 1993

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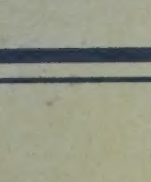

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NATIONAL SEMINAR ON INDIAN SWEETS INDUSTRY

HOTEL WEST END
BANGALORE, APRIL 30, 1993

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SEMINAR ON INDIAN SWEETS INDUSTRY

30 APRIL, 1993,
HOTEL WEST END, B'LORE.

PROGRAMME

9.00 – 9.30 am	Registration	
9.30 – 10.00 am	Inauguration	
	Welcome	Mr. A. Devariya
	Keynote Address	Dr. K.K. Iya
	Vote of thanks	Dr. A.M. Natarajan
Morning Session	Chairman	Mr. M.R. Chandrashekar
10.00 – 11.00 am	Presentation on Milk Sweets	Dr. K. Atmaram, UAS, Bangalore. Dr. J.S. Punjrath, NDDB, Anand Mr. VYAS.
	Discussions	
11.00 – 11.15 am	Coffee	
11.15 – 12.00 noon	Presentation on Non Milk Sweets	Mr. R.A. Radhakrishnan - Ramakrishna Dairy, B'lore Mr. N.B.Chitale, Chitale Bandhu Mithaiwale, Pune
12.15 – 1.15 pm	Presentation on Confectionery	Dr. S.N. Raghavendra Rao, CFTRI, Mysore Mr. Sudhakar Gupta, Lipton India Ltd., B'lore
	Discussions	
1.15 – 2.00 pm	Lunch	
Afternoon Session	Chairman	Dr. N.N. Dastur
2.00 – 3.00 pm	Audio Visual – Technology/ Packaging/Process Machinery	
3.00 – 4.00 pm	Presentation on Packaging	Dr. A.N. Srivatsa, DFRL, Mysore Mr. K.R. Kumar, CFTRI, Mysore
	Discussions	
4.00 – 4.15 pm	Tea	
4.15 – 5.00 pm	Presentation on Marketing	Mr. Paul Mathew, MBA Pvt. Ltd., Bangalore
	Discussion	
5.00 – 5.30 pm	Valediction	Dr. K.T. Achaya
	Vote of Thanks	Dr. R.R. Mohite

AFST(I)

Association of Food Scientists and Technologists (India), AFST (I), is a professional organisation dedicated to the advancement of all aspects of science and technology relating to the production, processing and distribution of food. It has its headquarters at CFTRI, Mysore. It seeks the dissemination and exchange of knowledge and experience among professionals and also the general public, promote the rational and economic development of food science and technology in the country, encourage research, development and training and promote among its members a high standard of technical proficiency, professional expertise and personal integrity.

AFST (I), Bangalore chapter, has more than one hundred members. The association regularly holds monthly meetings to promote fellowship and disseminate knowledge through technical talks by invitee speakers on topics of current interest in food science and technology. Once a year the association co-sponsors the prestigious Sri Meda Kasturi Ranga Setty Memorial oration lecture, arrange for training/special seminars. The association also comes out with a quarterly Newsletter for its members.

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Traditional Dairy Products in India

*Dr.K.K.Iya**

Although Indian Sweets Industry consists of a wide variety of sweets based on cereals, pulses, nuts, sugar, jaggery and fats besides dairy products, there is little doubt that a very significant proportion of sweets are based almost exclusively on traditional dairy products such as khoa, channa, concentrated milk, butter and ghee. I propose to discuss the role of traditional dairy products in our dairy industry and their use in Indian sweet industry. I shall make a passing reference to some products like paneer which although not used in sweets industry are important foods in our diet all over the country.

During the last 20-25 years or so milk production in India has gone up from about 25 million tonnes in 1970 to about 51.5 million tonnes in 1990 primarily as a result of the strengthening of the Cooperative Sector of the dairy industry under the Operation Flood programmes by NDDB in collaboration with state governments. During this period, peak milk procurement under Op-Flood from dairy cooperatives has gone up from 7,000,000 l/day in 1970 to 12,000,000 l/day in 1990. Organised milk marketing rose from 1,000,000 l/day in 1970 to 7,000,000 l/day in 1990. This has also resulted in the manufacture of increased quantities of milk powder as can be seen from the fact that from about 20,000 tonnes in 1970 the country is today manufacturing 165,000 tonnes/year (1990). It is interesting to note that some 46% of the milk produced is consumed as liquid milk. This proportion has remained more or less the same over the years leading us to the conclusion that almost 25 to 26 million tonnes of milk (about 50% of current milk production) goes for increased liquid milk consumption and for the increase in manufactured milk products in the organised and unorganised sector. Baxi (1991) states, "The milk powders, ghee, butter and cheese came to form the mainstay of the Indian dairy industry product-mix. This product-mix was possible due to the availability of production technology and distribution infrastructure which could effectively and efficiently reach the product to the scattered premoninantly urban markets from the localised rural centres of production."

The organised sector of the dairy industry may be considered to be handling about 20-25% of the total milk production daily and the balance 75% or so of the production is handled by the unorganised sector for selling it as liquid milk and for manufacture of milk products, of which traditional milk products including ghee account for substantial proportions of the product mix of the unorganised sector. Mahadevan (1991) compiled an interesting table presented below to illustrate the consumption of milk and milk products.

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Present address: No. 90, 9th Cross, RMV Extn., Bangalore - 560 080

Table 1 Consumption of Milk and Milk Products in India, 1989-90

Product	Product quantity Metric Tonnes (000)	Milk equivalent (000 MT)	% of total milk production
Liquid milk	23,460	23,460	45.7
Butter milk (by product of Desi butter & ghee making)	17,600	17,600	34.2
Dahi	3,570	3,570	6.9
Butter (Table)	210	-	-
Ghee	710	-	-
Cream	13	105	0.2
Paneer & Cheese	153	956	1.9
Khoa & Condensed milks	700	3500	6.8
Milk powders including infant milk foods	165	1922	3.7
Ice-cream	40	325	0.6
		51,438	99.0

Channa which is estimated to account for about 4% of total milk production seems to have been left out for some reason. Nevertheless, it must be emphasised at this stage that the data base in dairy industry in production, processing and marketing rests on "guestimates" since almost 75% of the total production is in the unorganised sector. It is essential that a systematic survey is undertaken on the pattern of utilisation of milk in some detail by NDDB, the state governments, the cooperatives and the Planning Commission (Agricultural Statistical Organisations).

Aneja estimates that the value of khoa and channa produced in India is probably twice the value of milk handled by the organised sector.

Let us see the different traditional dairy products being made and consumed in our country. Mathur classifies them broadly under 4 heads

- Heat desiccated
- Heat/acid coagulated
- Fat rich, and
- Frozen products

Amongst the heat desiccated products almost 322,000 Metric tonnes of khoa representing 7% of total milk production stands out as a major traditional milk product valued at Rs.12800 crores or more at today's prices. Three main types of khoa are made — Pindi used in innumerable varieties of Burfi and Peda manufacture, Danedar preferred for Kalakand, granular Burfi, Milk Cake and granular Milk sweet making and the third type Dhap used chiefly in Gulab Jamoon and Pantooa making. Most of the khoa made is on a small scale-4-6 litre lots of buffalo milk.

The other heat desiccated products are Rabadi Khurchan which are popular in Northern and North Eastern parts of the country.

Heat and acid coagulated products are channa which accounts for 4% of total milk production and is used as a base for Rasogolla, Rasamalai, Chum Chum, Sandesh, Pantooa, Channa murki and many other sweets popular in Eastern parts of the country and are mainly cow milk products.

Paneer utilises some 4-5% of total milk production, is now becoming increasingly popular all over the country. Dahi which uses about 15% of total milk production is an intermediate stage product of ghee made from desi butter. Dahi for domestic use is made by individual families at home although some small quantities of dahi are sold by unorganised producers also. Dahi is also an intermediate product from which chakka is made which with addition of sugar is made into

Srikhand. This product is extremely popular in Maharashtra and Gujarat and their border districts. Srikhand is made as an assembly line operation, fully mechanised in manufacture and packaging by the Sugam dairy — set up as an R & D unit of NDDB with a sales turnover for one town of Baroda alone at over 750 metric tonnes, nearly half of its total annual sales turnover of 1600 tonnes. The sales of Srikhand from Sugam alone exceed sale of all western types of cheeses sold in the entire country.

Table 2 Prices of Indian Milk and Milk Products (1990)

Period	Price (Rs.)
Liquid milk (loose)	6/litre
Liquid milk packed in bottles/sachet	6.50/litre
Liquid milk in paper cartons	9/litre
Table butter	86/kg
Skim milk powder	42/kg
Whole milk powder	68/kg
Infant milk food	62/kg
Sweetened condensed milk	48/kg
Ghee	70/kg
Khoa	40/kg
Peda	45/kg
Dahi	10/kg
Channa	27/kg
Rasogolla	90/kg
Gulab jamoon	55/kg or Rs.2 per piece

The byproducts of Dahi are Lassi and Mattha, former diluted with water and latter undiluted, drawn after butter is taken off, with salt, sugar etc. added to taste.

Amongst fat rich products, Ghee is king and some 39% of total milk produced is utilised for dahi, butter, ghee operation. The annual sales turnover of ghee is 710,000 metric tonnes valued at Rs.49,700 crores (Rs.70/kg). Ghee varies in taste, texture and flavour (aroma) in different parts of the country and is used in a wide variety of ways including for the manufacture of Indian sweets of milk and non-milk origin. It would be interesting to review the situation in a few years when the awareness of dangers of animal fat consumption, high cholesterol intake, atherosclerosis and other heart ailments is more widespread amongst young people. There are already sign amongst urban and modern young to abstain from the use of ghee and butter in their diet.

Amongst frozen products Kulfi and Malai ka Baraf are popular in Northern and Western India. Their total production is only a small fraction of total milk production. Even Ice cream, a modern dessert and snack food sweet product utilises only 0.6% of total milk production for a total of 40,000 metric tonnes of ice cream shared almost equally by organised and unorganised sectors.

A schematic flow diagram of conversion of milk into traditional Indian Dairy products is given by Punjrath and is presented in figure 1.

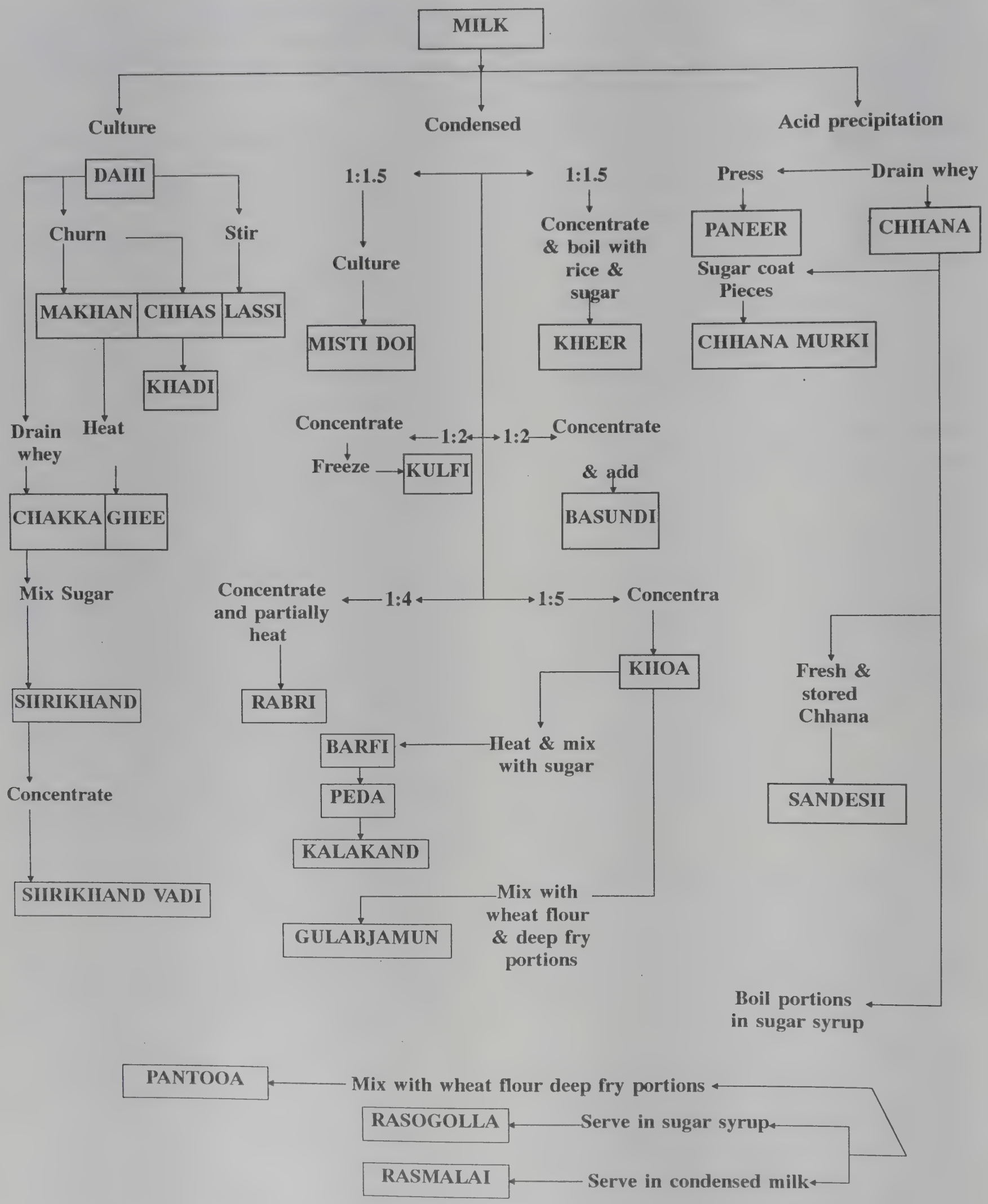

Fig 1. Flow chart of conversion of Milk into traditional Indian Dairy products

Table 3 Quantity of milk needed to make Traditional Dairy Product and raw material cost as percent of sale price (Data from Aneja and Dairy India, 1992)

Product	Product requirement of milk to make 1 kg of product		Raw material cost as % of sale price
Market milk			90% Bulk vended
Ghee	18 litres of milk	6% fat	80% packaged
Khoa Peda, Burfi, Kalakand	5 litres of milk	6% fat	
Khurchan (Rabadi)	3 litres of milk	6% fat	35
Channa	8 litres of milk	3% fat	
Rasagolla	1.5 litres of milk		33
Sandesh			39
Mishti Doi	1.20 litres milk		
Srikhand	2.20 litres of milk	2.4% fat	29
Paneer	5.00 litres of milk	5% fat	65
Gulab Jamoon	1.00 litre of milk	6% fat	34
Ice-cream mix	1.60 litres of milk	6% fat	
Dahi	1.00 litre of milk		

The traditional dairy products have a distinct advantage in that they are value-added products. The net realisation by sale of these products is far more than sale of milk of even some of the western dairy products. This may be seen from Table 3 showing the quantity of milk required to make these products and the cost of raw material as percentage of sale price for these products.

The actual sale price of the traditional dairy products particularly the Indian Sweets such as Peda, Burfi, Kalakand, Rabadi, Gulab Jamoon, Sandesh, Rasagolla, Rasamalai, Srikhand, Mishti Doi, Paneer or ice cream may be termed as Fancy Price depending upon the prestige and name of the Halwai, the festive season and occasion and several similar factors. A small addition of dry fruits like almonds, cashewnut, walnut or a trace of flavours like saffron can boost up the price of these sweets substantially. These products do not have long shelf life even in refrigerator and need to be kept in ambient temperature for their taste, flavour and texture to be relished by the consumer at their best.

It is necessary to make technoeconomic surveys for the manufacture of some of the selected traditional dairy products. Such studies are reported in Dairy India 1992 for ice-cream, and processed cheese. Experience of such dairies as Sugam Dairy, NDDB in Baroda for Srikhand, Gulab Jamoon, Peda and Rasogolla would be useful for Dairy Federations in diversifying operations to include the manufacture and marketing of Indian sweets with their respective brand names within the state and nationally in the first instance and then take up export. Many dairy units of Dairy Federations are currently manufacturing Peda made from khoa but the processing technology, handling and marketing need drastic changes if the operations are to be expanded. Engineering innovations for technology of khoa making such as Thin film Scraped Surface Heat Exchanger, SSHE, for continuous khoa or continuous ghee making reported by Abhichandani,

Dodeja and Sarma as well as by Punjrath need to be tried out under factory conditions in dairy plants. There is a case to undertake experimental pilot plant assembly line operations for Paneer, Chakka, Srikhand manufacture also. Some private dairies are on the way to seriously consider channa making and the manufacture of rasamalai, rasagolla and similar sweets, mishti doi etc. for partial automation. Modern packaging materials and machinary now can give elegant packaging of many Indian sweets in different sizes in attractively printed packages.

There are now distinct surpluses and seasonal glut in milk procurement in some states and even after long distance transport of liquid milk to far off urban markets in the Milk Grid System some dairies have had perforce to declare procurement holidays hurting the milk producers. A recent report states in the Hindu of April 16, 1993 that 13 milk dairies of Karnataka Milk Federation procured during flush season of 1992-93 a record of 14.63 lakh litres a day against its handling capacity of 11 lakh litres a day. The story is similar in some other Southern states besides many Western and Northern dairies. Such seasonal supluses have been a problem in past years and will cause problem in futue years although some lean years cannot be ruled out. The important point is to realise that our dairy industry may have to change its product mix from conventional Skim-milk powder-butter-ghee to introduce traditional milk products such as Khoa, Channa, Paneer, and Cheese and Ice cream. This will also become necessary as in my view the urban young today are giving up butter and ghee from their dietary and favouring low fat, high protein, high minerals containing dairy products. They are not averse to Indian traditional sweets for celebrations and festivities. These traditional Indian milk products will enable the dairy plants to become economically viable and also sustain liquid milk, skim milk flavoured milk, etc. being produced.

However, for this change in strategy of Dairy Plant operations dairy plants will need to

- ➤ strengthen quality control set up
- ➤ engineering and technological innovations and equipment layout geared for new product lines
- ➤ R&D set up with product development cells
- ➤ good marketing organisation as distinct from mere sales organisation and
- ➤ efficient byproduct recovery.

If the dairy plants can rise to the occasion, the surpluses of milk production will be advantageously used by consumers, dairies will not have to face flush season problems and financial picture of dairy federations will be healthier. Let us hope enlightened management will guide the industry to face the challenges of 21st century for the benefit of all sectors of the industry.

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Indian Milk Sweets

*Dr. K. Atmaram**

India ranks first in Asia and fourth in the world in milk production. Milk and milk product play a vital role in the agricultural economy of the country. Currently valued close to Rs. 2000 crores annually, milk and milk products are now the second largest contributor to agricultural produce of the country. It is estimated that roughly 50 percent of the total milk production is utilised for manufacture of indigenous milk products mainly by the unorganised sector. These milk products represent higher value added products with great export potential.

More then 50 million litres of milk per day are utilised for conversion into indigenous milk products. Traditionally, these indigenous milk products and milk sweets have been manufactured by halwais and small entrepreneurs. Recently a few organised dairies have started commercial production of some of these milk sweets but the contribution of the organised dairy industry is for less significant.

Most of these milk sweet are popular through out the country although a few of them are region specific. In addition to their significant dietary and nutritional roles, many of these have social and ceremonial connection.

Depending upon the method used for their manufacture, these indigenous milk sweets could be classified as:

Heat desiccated products

those made from Khoa :

- Peda
- Burfi
- Gulabjamun
- Kalakand

other heat desiccated products.

- Rabri
- khurchan
- Pyodhi

Acid precipitated products

- Rasagolla
- Pantooa
- Sandesh
- Rasamalai Channa serves as base material for these sweets of the Eastern States of India.

Fermented (cultured) Products

- Srikhand : Prepared by draining dahi overnight in a muslin cloth. Chakka thus obtained is used for manufacture of Srikhand.
- Misti Doi

Cereal based products

- Kheer

  Rice cooked in milk and thickened. It is sweetened with sugar and served hot or chilled with nuts.

- Payasam

  Thickened milk cooked with cereals, sweetened and flavoured.

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Distinct variations in the sensory, rheological, chemical and microbiological properties of milk sweets could be observed in the market.

The major problems appear to be:

- Lock of well defined sensory and rheological characteristics
- Chemical variations
- Unclean environment, and
- Microbiological hazards

The low shelf life is one of the main limiting factor in marketing since milk sweet on storage undergo many types of sensory, rheological, chemical and microbiological deteriorations making them unfit for human consumption. Several attempts have been made to improve the keeping quality of indigenous milk sweets. There is need for transfer of technologies for adoption by the traders. Use of standard sanitary practices in production, clean packaging, environment, cold storage facilities and maintenance of cold chain need be stressed for enhancing the shelf life of these products. Application of safe, preferably natural food preservatives, may be another approach which could be explored for improving the shelf life.

Large scale production and packaging has been attempted for manufacture of Srikhand, Gulabjamun, Peda, Sweet lassi, however, these products still differ in texture and tastes from that of the traditionally made milk sweet.

There is need to promote modernisation of manufacture, packaging and marketing of Indian milk sweet, improving efficiency in production by efficient systems and technologies and assurance of quality are necessary. The R & D on milk sweets and allied indigenous products have to be geared up for the purpose.

Mechanisation of Milk Sweets Manufacture

*Jagjit S Punjrath**

Introduction

India today produces 59 million MT of milk. After the USA, India is the second biggest milk producing country in the world. Milk and Milk products constitute the second largest gross agriculture produce of the country. The value of milk and milk products now exceeds Rs.40000 million every year. A significant amount of milk produced in India has been traditionally converted into a variety of sweets. The practice seems to have originated because of staggered production in remote areas, regional/seasonal surpluses, difficulties in transport/marketing and perishable nature of milk.

Milk produced in excess of the daily requirement for direct consumption is traditionally converted into various dairy products with longer shelf life. The nature of product manufactured depended upon the shelf life desired. The products like Dahi were obtained by fermentation of milk and extended the shelf life of milk by a day or two. For intermediate shelf life, products like Makkhan (butter), Khoa, Chhanna were manufactured. In case longer shelf life was desired, products like ghee were manufactured. Most of these products acted as a base for the production of more sophisticated and more popular sweets like Shrikhand, Burfi, Gulabjamun, Peda, Rasgulla, Sandesh etc.

In spite of the fact that the dairy industry has made rapid strides in the last 3-4 decades, the methods of manufacture of the traditional products have remained essentially unchanged except for a few isolated products. Most of the developments in the dairy sector in India have been directed towards manufacture of western dairy products for which equipment and were readily available from industrially advanced countries.

With the increase in availability of liquid milk, development of more competition for the western type dairy products and improvement in per capita income after independence, there is increased pressure for restructuring of the indigenous milk based sweets industry. The organised sector has started showing keen interest in processes and equipment for large scale manufacture of these products in the organised sector. Any innovation which can enable the organised sector to manufacture and market indigenous milk sweets on industrial scale can have far reaching impact on the dairy industry as well as on the social and economic condition of milk producers in the country.

Classifications of Indigenous Milk Products of India

The indigenous milk products of India can be broadly classified into the following three categories, depending upon the method used for their manufacture:

Condensed (Heat dessicated) Products

Khoa, Burfi, Gulabjamun, Peda etc.

Cultured Products

Dahi, Makkhan, Chhas, Lassi, Shrikhand, etc.

Acid Precipitated Products

Paneer, Chhana, Sandesh, Pantooa, Rasgulla, etc.

* General Manager (PT), National Dairy Development Board, Anand 380 001

A Flow chart on method of manufacture of different dairy products is shown in Figure 1. It need not be emphasised that like any other product manufactured by small scale industry the organoleptic, physio-chemical attributes and functional requirements vary widely even for same category of product.

The quality/type of milk, the functional requirements, the cost etc., sometimes make the classification quite difficult if not impossible and development of plants and processes based on so many variables becomes many times more challenging.

Technological Innovation in Khoa Making

The traditional method, consists of taking 4-6 litres of buffalo milk, and boiling it over direct fire in a shallow pan (mild steel) with vigorous stirring and scrapping. Within 5-10 minutes a semi-sold mass is formed that begins to leave the surface of the pan. Whole buffalo milk is preferred. The details of the manufacturing process and factors affecting the quality attributes are not covered in the present paper only the technological innovations in the process equipment are discussed.

Most of the attempts in development of Khoa making process have been directed towards development of plant which would enable the industrialisation of khoa making process through mechanisation. A semi-continuous Khoa making machine was developed by Banerjee et al in 1976. The plant consisted of a scraped surface heat exchanger and two open semi-jacketed pans with reciprocating spring loaded scrapers. (Figure-2)

Milk (12-13% total solids) was pumped in the scraped surface heat exchanger for preheating and concentration of 30-35% total solids. The first stage of the open semi-jacketed pan further concentrated the milk of 50-55% total solids. The final concentration of 70-75% total solids was achieved in the second pan. The equipment had a capacity of 50 litres of milk per hour.

Sawhney et al in 1980 mechanised the traditional batch process by providing a semi-jacket, shallow open pan and using swinging hanger type scraper for stirring during the dessication process. The use of steam for heating permitted a better control of temperature. More, (1985) designed semi-mechanised scraped surface heat exchanger consisting of semi-jacketed drum with vapour exhaust and scraper assembly, comprising spring loaded blades rubber boots, and a central shaft (Figure-3). Both these processes remained essentially batch processes.

Attempts to adopt the available equipment such as vacuum evaporators for preconcentration and finishing in steam jacketed kettle with mechanical scrapers or vacuum evaporator and roller drier also resulted in limited success. The major problem encountered in these processes was the unstability of the process and absence of typical flavour, texture, taste and other physio-chemical and functional attributes. Membrane processes for preconcentration have also been tried followed by dessication in open vats. Such processes have not been successful for whole milk because of fouling of membrane due to milk fat. Preconcentration of skim milk followed by standardisation of fat with cream and dessication is not only cumbersome but also results in inferior quality product.

Contherm, convap system developed by Alfa Laval has also been used for manufacturing Khoa. One of the manufacturers has been able to use this process successfully to manufacture Khoa on a large scale, however, experience in other establishments has not been very encouraging. It seems the process can be utilised for manufacture of Khoa with sticky body or fine texture if adequate precautions are taken to maintain uniform steam pressure in the jacket and continuity of the flow of the product in the plant.

A conical vat machine has recently been developed in NDRI Karnal. The plant does not give uniform quality product and results in high losses (Figure-4).

The latest innovation is the development of an inclined scraped surface heat exchanger for continuous Khoa making by the NDDB. The machine is shown in Figure-5. The plant comprises a balance tank, a positive displacement pump and an inclined Scraped Surface Heat Exchanger (ISSHE). Milk concentrate used as feed is pumped into the ISSHE at the desired flow rate by adjusting the capacity of the feed pump.

The inclination of ISSHE, permits formation of a pool of boiling milk critical to formation of Khoa. Subsequently, fresh concentrated feed enters the pool of boiling concentrated milk while an equivalent mass continuously leaves the pool as semi solid mass. The scraper repeats the process of removing of coagulated particles from the heat transfer surface and mixing them back into the pool of heated milk. The coagulated particles absorb milk resulting in the agglomeration and formation of characteristic Khoa texture. The inclination of the scraper provides interface between metal, milk and air which enhances the heat coagulation of proteins. The traditional process of Khoa making as it takes place in a "KARAHI" (traditional open pan) is replicated in the ISSHE. The wet coagulated particles are pushed ahead by the screw conveyor provided as an integral part of the rotor for further evaporation and the concentrated milk flows back to the pool.

By varying the inclination, flow rate, pressure in the heating jackets, scraper/screw speed and total solids and the temperature of the feed, the capacity, residence time and product characteristic can be varied to meet the functional requirements. Rajorhia et al compared the quality of Khoa prepared using different mechanised systems (Inclined Scrapped Surface Heat Exchanger, Conthermconvap System, Roller Drier and Conical Vat). The physio-chemical characteristics, sensory properties, rheological properties and operational feature of different systems compared by Rajorhia et al are shown in Table 1, 2, 3 and 4.

The sensory characteristic of Khoa prepared by ISSHE were similar to those of traditional product and the chemical composition and rheological properties of Khoa maintained uniformity during continuous operation. ISSHE was found to be compact and simple. The ISSHE process is now being used on a regular basis in Sugam Dairy, Baroda and Milk Plant at Bikaner with excellent results. Six more plants are being manufactured for other dairies.

Technological Innovation in Shrikhand Manufacture

Shrikhand is an excellent example of how innovations in traditional sweets manufacturing processes can help the dairy industry improve its viability and also provide the consumers a safe, nutritious product of assured quality.

In the traditional method, Buffalo Milk or mixed cow milk is boiled and after cooling to room temperature (30-35°C), it is inoculated with lactic culture (dahi) and incubated for 6-8 hours. When the curd is firmly set (acidity 0-9 to 1-0%), it is placed in a muslin cloth bag and hung on a peg for drainage of whey for 6-8 hours. The curd is intermittently squeezed to faciiitate whey drainage. The solid mass thus obtained (called Chakka or Maska) is mixed with sugar and well kneaded and rubbed through a muslin cloth to give a smooth sweet and sour product. Colours, flavours and fruits are also added to provide variety.

Use of non-standard mixed culture, unhygienic manufacturing practices, absence of quality packaging and cold chain arrangements limited the shelf life and sometimes made the product quite unsafe. Manufacture of product on large scale was also a serious problem and quality of product varied widely from batch to batch. The process line developed by the National Dairy Development Board for industrial manufacture of Shrikhand is shown in the Figure-6.

In this process, Skim Milk curd made with a Standard culture under controlled conditions from pasteurised skim milk is centrifuged in a continuous quarg separator to produce Chakka which is mixed with cream, sugar and flavourings in a scraped surface heat exchanger for manufacture and pasteurisation of Shrikhand. The product is then filled in a form, fill and seal machine under semi-asceptic environments before despatch for retail trade. The incorporation of modern technology and radical innovations in the traditional practices has not only made possible manufacture of a safe, uniform, high quality product but has also enabled the organised sector to manufacture the product on industrial scale and expand market segment and improve their financial performance. The Sugam dairy at Baroda which is using the method developed by NDDB is the market leader and is also exporting the product to other states and countries.

Technological Innovations in Gulabjamun Manufacture

In the traditional method, dough is made by uniformly mixing followed by kneading khoa, Wheat flour and baking powder in the (approx.) ratio of 100:10:1, respectively. The dough is then rolled into small balls and then deep fried in ghee/edible oils in a shallow pan till the balls acquire a golden brown colour. The balls are then removed and put into a 60% sugar solution and allowed to soak for a few hours before being served.

The process line developed by NDDB for large scale manufacture is shown in Figure-7. The line is in commercial production at Sugam Dairy, Baroda. The raw materials (Khoa, Wheat flour and baking Powder) are mixed in a planetary mixer. The dough is then fed to a portioning machine. The portioned mass is shaped into balls in a ball rolling machine before going to a continuous ball frying machine for frying under controlled environment (time-termperature combination can be varied to control the quality attributes - softness, textural qualities, colour etc.). The balls after frying are fed to a sugar syrup soaking tank. Ready Gulabjamuns then go to cup filling and sealing machine. The Gulabjamun line at Sugam Dairy can manufacture upto 600 kgs. of the Product in each shift. The product is now being exported.

Mishti Doi

Mishti Doi is a highly nutritious, palatable, sweetened, fermented milk product available generally as a set curd product. Mishti Doi is very popular in the Eastern part of India especially in the state of West Bengal.

The traditional method for manufacture of mishti Doi comprises various steps viz. Preparation of milk concentrate with or without addition of starch (wheat flour/maida), colouring and flavouring the concentrate with burnt sugar, inoculating the previous day's product, dispensing the cultured mix in earthen bowls, incubating these overnight by keeping the bowls near a chulha without any control over the incubation temperature, acidity development etc.

NDDB has developed an improved and hygienic industrial scale process for preparing Mishti Doi which includes the process of making "Base-Mix" with predetermined level of milk fat, milk solids not fat, sugar and caramel; heating the base-mix to 90°C; cooling down to 42-45°C; inoculating with a starter culture; filling in the polystyrene cups; sealing; incubating at 42°C till the desired level of acidity is reached. The product is immediately transferred to the cold store.

The product is being manufactured at Mother Dairy, Calcutta. The Flow Diagram for the manufacture of Mishti Doi is given in Figure-8.

Innovations in Process Equipment, Other Indigenous Milk Products

Chhana is heat acid coagulated milk product which forms the base of several popular Indian sweets such as rasgulla, Rasmalai, Sandesh, Chum Chum, etc. Typically cow's milk is taken in a boiling pan (2-40 litre/batch) and coagulated at high temperature using sour whey. Whey is drained off by straining through a cloth. A prototype equipment for the manufacture of channa with a capacity of 40 kgs/hr has been developed at the National Dairy Research Institute, Karnal (Figure-9). Standardised milk is pumped to a vertical insulated tank at the rate of 250 litre/hr. Culinary steam at 1 kg/cm2 is injected into milk through a ventury system. Sour whey is introduced at this juncture and the mixture allowed to flow into a chamber where coagulation is completed. Coagulated mass is then allowed to flow through a double jacketed tube with tap water circulation. Chhana is drained in two stages, firstly over an inclined sieve jacket and then over a slow moving conveyor belt. Short shelf life is the major problem encountered with the product obtained by this process.

Rasogolla is a major chhana based milk sweet. Though the product has its origin in the Eastern part of the country, this milk sweet is now a days commonly consumed throughout the country.

Standardised milk is heated to boiling and cooled down to 80°C in the vat and previous day's whey is added for coagulation. Chhana is dipped in whey for about half an hour. Whey is drained out by straining. The Chhana is kept for draining by hanging in muslin cloth. After kneading chhana

is converted into balls through a portioning machine. For cooking of the Rasogolla, specially designed shallow steam kettles are used. After cooking Rasogollas are dipped in sugar syrup. The finished product is generally packed in tin cans. There are many brands of Rasogollas available in the market, leader being M/s. K.C.Das. The flow diagram for the manufacture of Rasogolla is given in Figure-10.

Paneer is an indigenous white cheese (unripened) which is used extensively as an ingredient in many vegetarian delicacies (especially in Northern India, Pakistan and Afghanistan).

Milk (preferably buffalo milk) is heated to about 80°C and coagulated at 70°C using mostly citric acid and coagulant. Whey is then drained through cloth lined hoops and pressing the coagulation to form blocks. Blocks thus formed are floated in chilled water for firming their body. Process equipment used for manufacture of TOFU has been successfully adopted for manufacture of Paneer on a commercial scale in NDDB, Anand. Similarly, UHT processing and aseptic packaging are being used to manufacture and market "LASSI" on industrial scale. The canning equipment is also now being commercially used to make sterilised tinned Rasgullas with increased shelf life and extended the market to larger areas.

Conclusions

The market for indigenous market based sweets far exceeds the market for western dairy products like Butter, Milk Powder and Cheese. A great scope exists for further growth and expansion of the market for indigenous milk products provided the quality and safety are ensured and shelf life is extended to facilitate distribution over larger areas. There is an imperative need to define technological parameters of these processes so that unit processes/process lines required for the large scale manufacture of these products can be developed. A beginning has already been made. However, a lot needs to be done.

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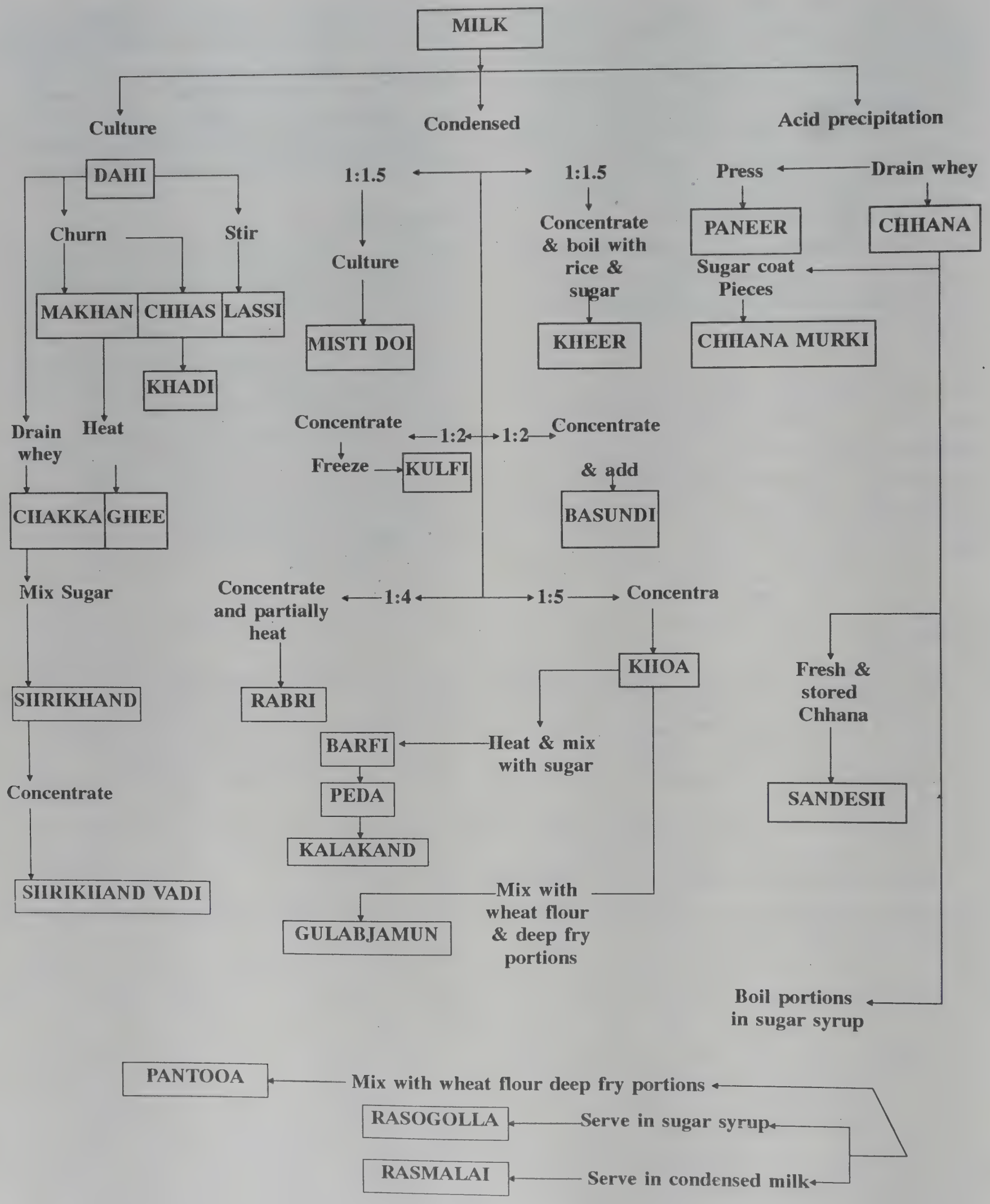
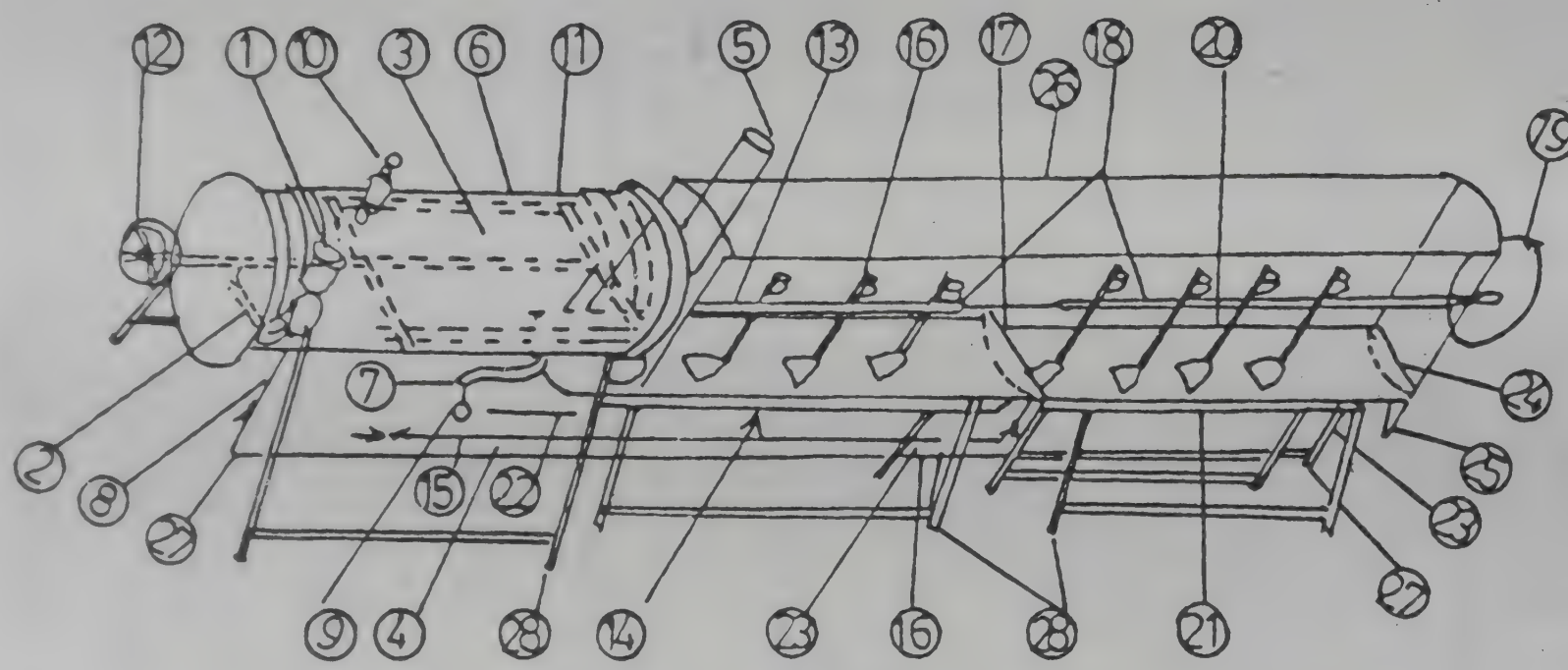


Fig 1. Flow chart of conversion of Milk into traditional Indian Dairy products

Figure-2 Continuous Khoa Making Plant



1. Milk Inlet
2. Milk Inlet Value
3. Drum Heater
4. Milk Outlet Value
5. Vapour outlet
6. Steam Jacket of Drum Heater
7. Steam Inlet to Drum Heater
8. Condensate Outlet
9. Pressure Gauge
10. Safety Valve
11. Rotary Scrapper
12. Pulley
13. Open Pan No. 1
14. Steam Jacket
15. Steam Inlet Valve
16. Condensate Outlet
17. Milk Outlet Valve Pan No. 1
18. Reciprocating Scrapper
19. Driving Mechanism
20. Open Pan No. 2
21. Steam Jacket
22. Steam Inlet Valve
23. Condensate Outlet Valve
24. Khoa Outlet Valve
25. Khoa Outlet Pipe
26. Cover
27. Steam Traps
28. Stand

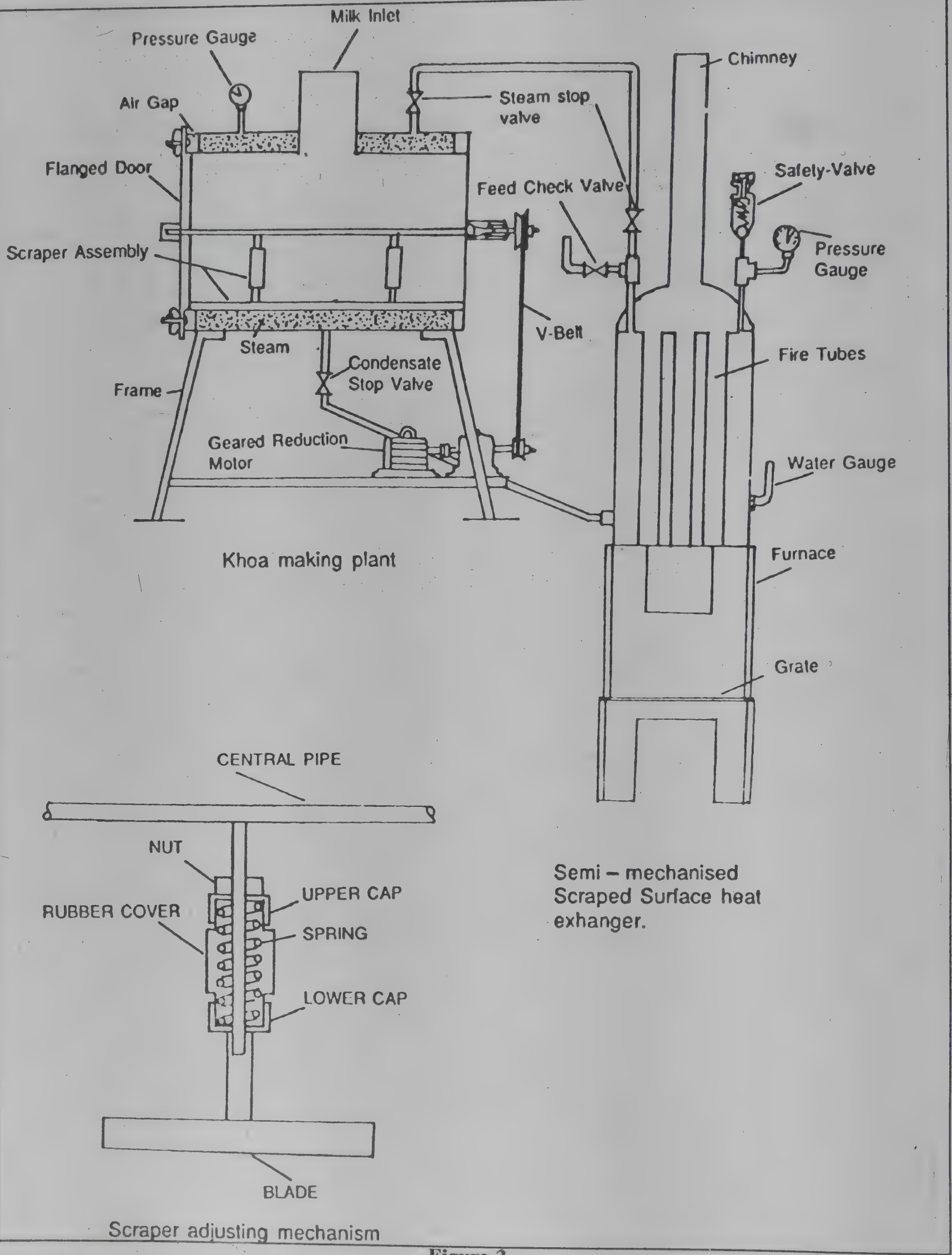

Milk Inlet
Pressure Gauge
Air Gap
Steam stop valve
Chimney
Flanged Door
Feed Check Valve
Safety-Valve
Pressure Gauge
Scraper Assembly
V-Belt
Steam
Condensate Stop Valve
Fire Tubes
Frame
Geared Reduction Motor
Water Gauge
Furnace
Grate
Khoa making plant
CENTRAL PIPE
NUT
UPPER CAP
RUBBER COVER
SPRING
LOWER CAP
BLADE
Scraper adjusting mechanism
Semi – mechanised Scraped Surface heat exhanger.

Figure-3

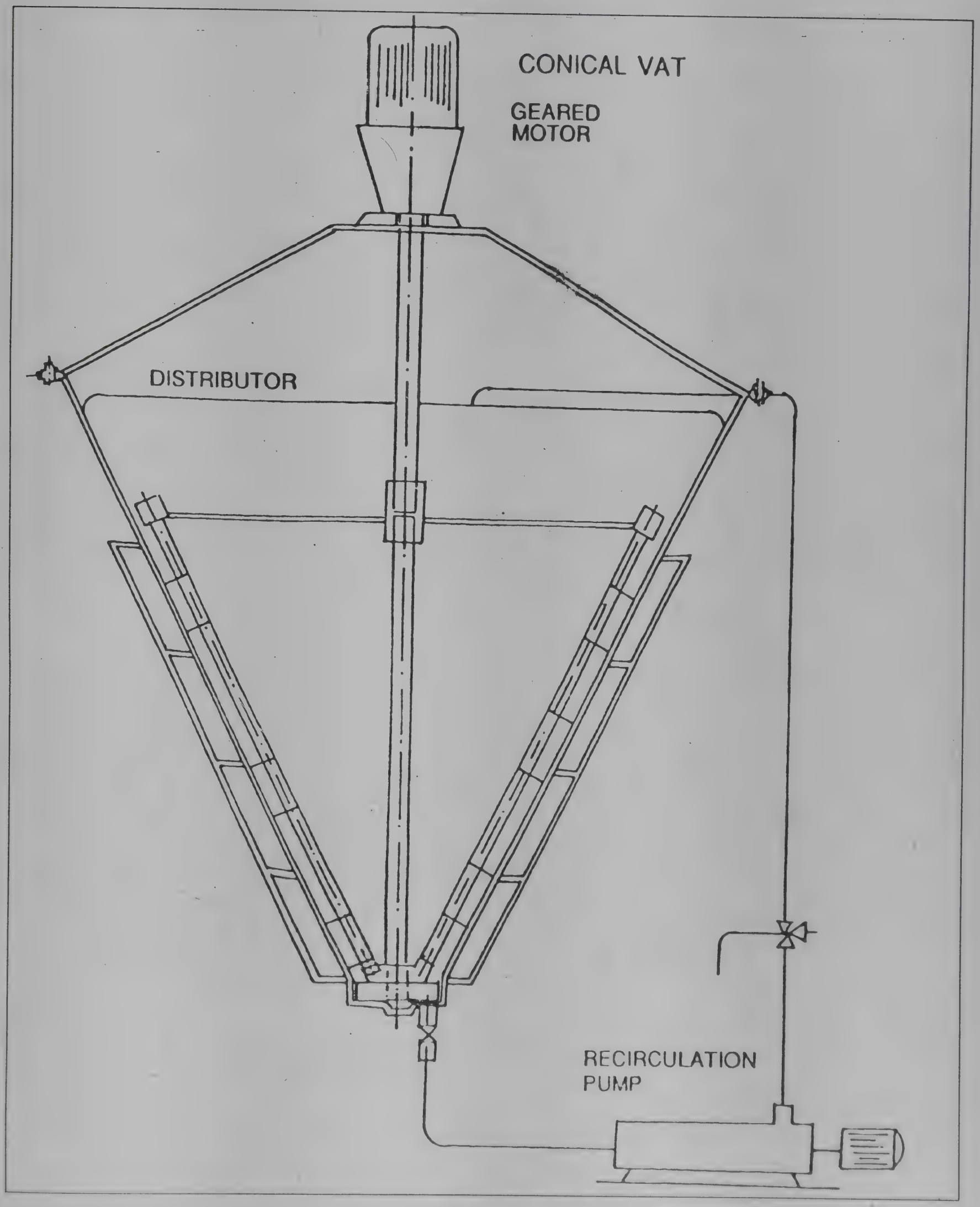
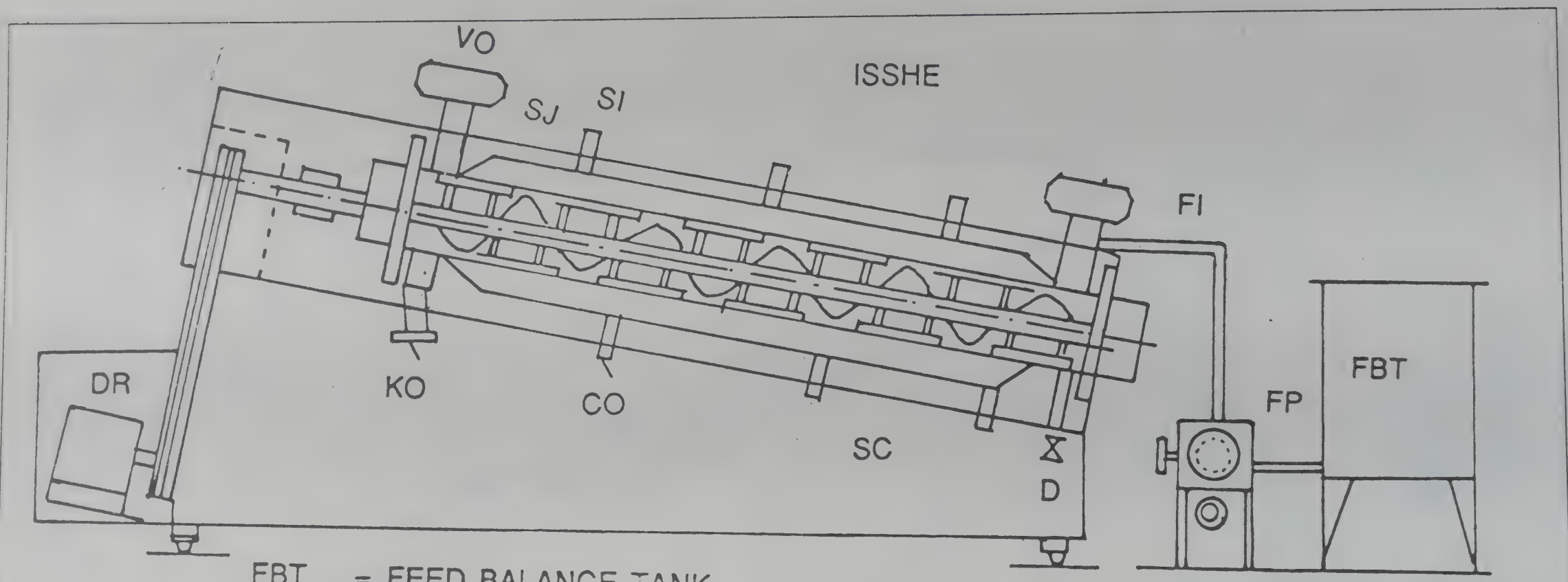


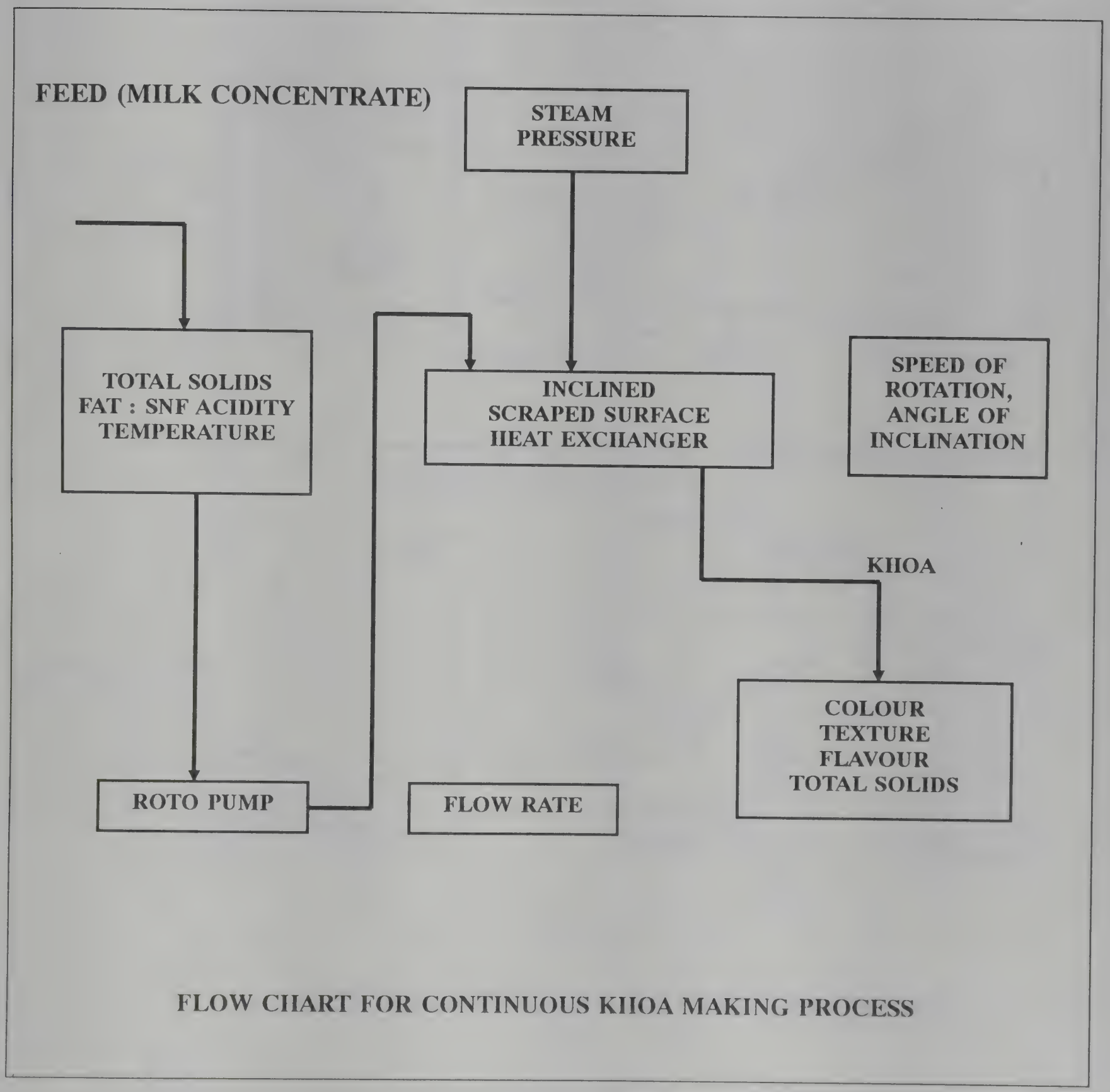
Figure-4

Figure-5



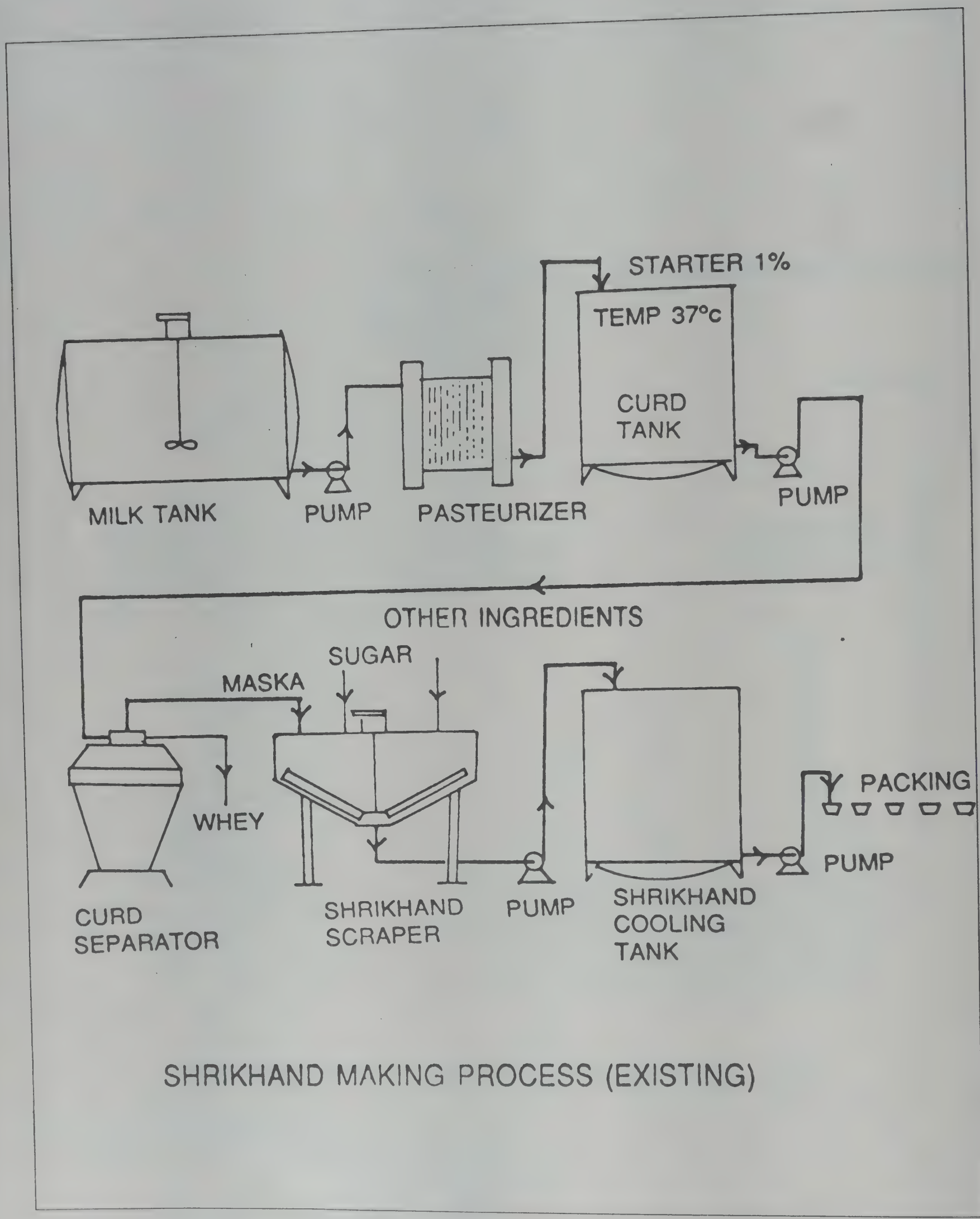
FBT = FEED BALANCE TANK
KO = KHOA OUTLET
CO = CONDENSATE OUTLET
FP = FEED PUMP
VO = VAPOUR OUTLET
FI = FEED INLET
SC = SCRAPER
SI = STEAM INLET
DR = DRIVE
D = DRAIN
ISSHE = INCLINED SCRAPED SURFACE HEAT EXCHANGER
SJ = STEAM JACKET

DB CONTINUOUS KHOA MAKING PLANT



FLOW CHART FOR CONTINUOUS KHOA MAKING PROCESS

Figure-5a



SHRIKHAND MAKING PROCESS (EXISTING)

Figure-6

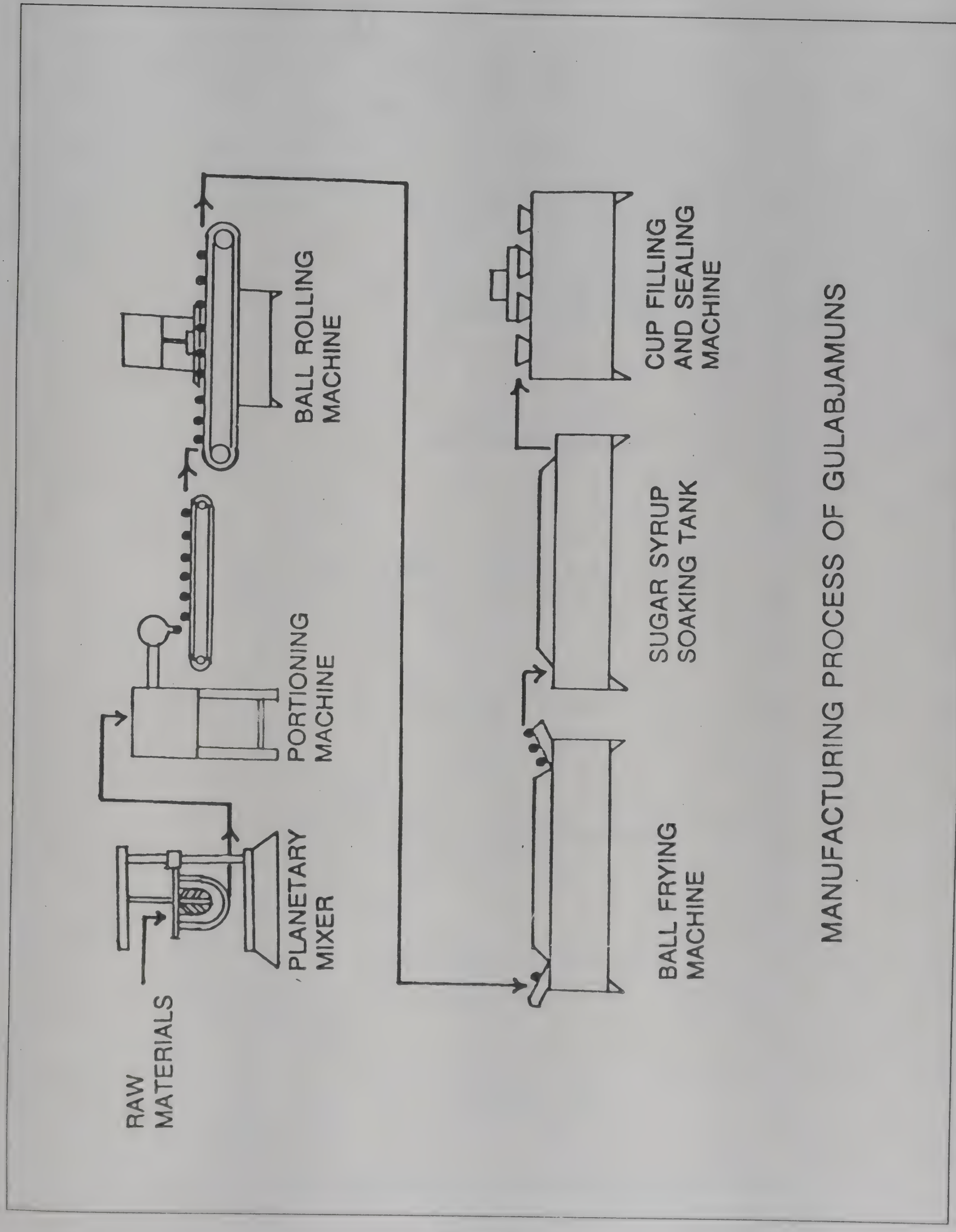
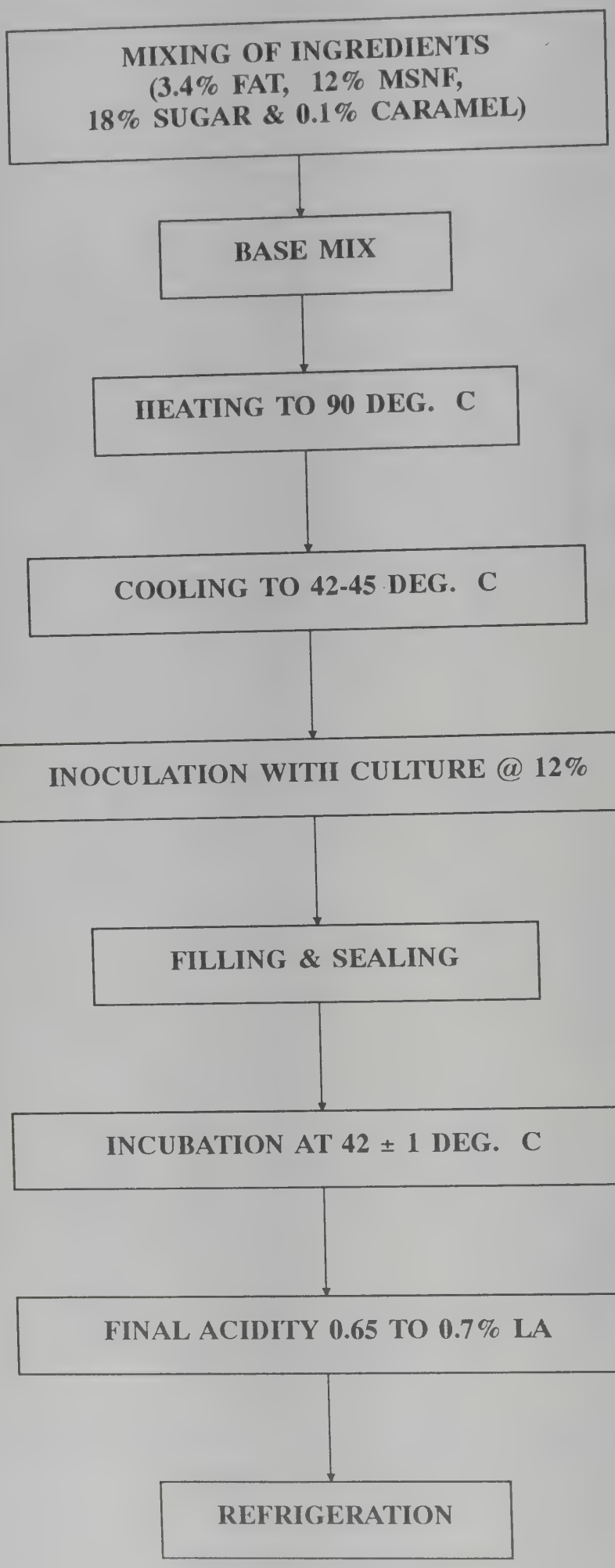

MANUFACTURING PROCESS OF GULABJAMUNS
RAW MATERIALS
PLANETARY MIXER
PORTIONING MACHINE
BALL ROLLING MACHINE
BALL FRYING MACHINE
SUGAR SYRUP SOAKING TANK
CUP FILLING AND SEALING MACHINE

Figure-7



FLOW DIAGRAM FOR MISHTI DOI MANUFACTURE

Figure-8

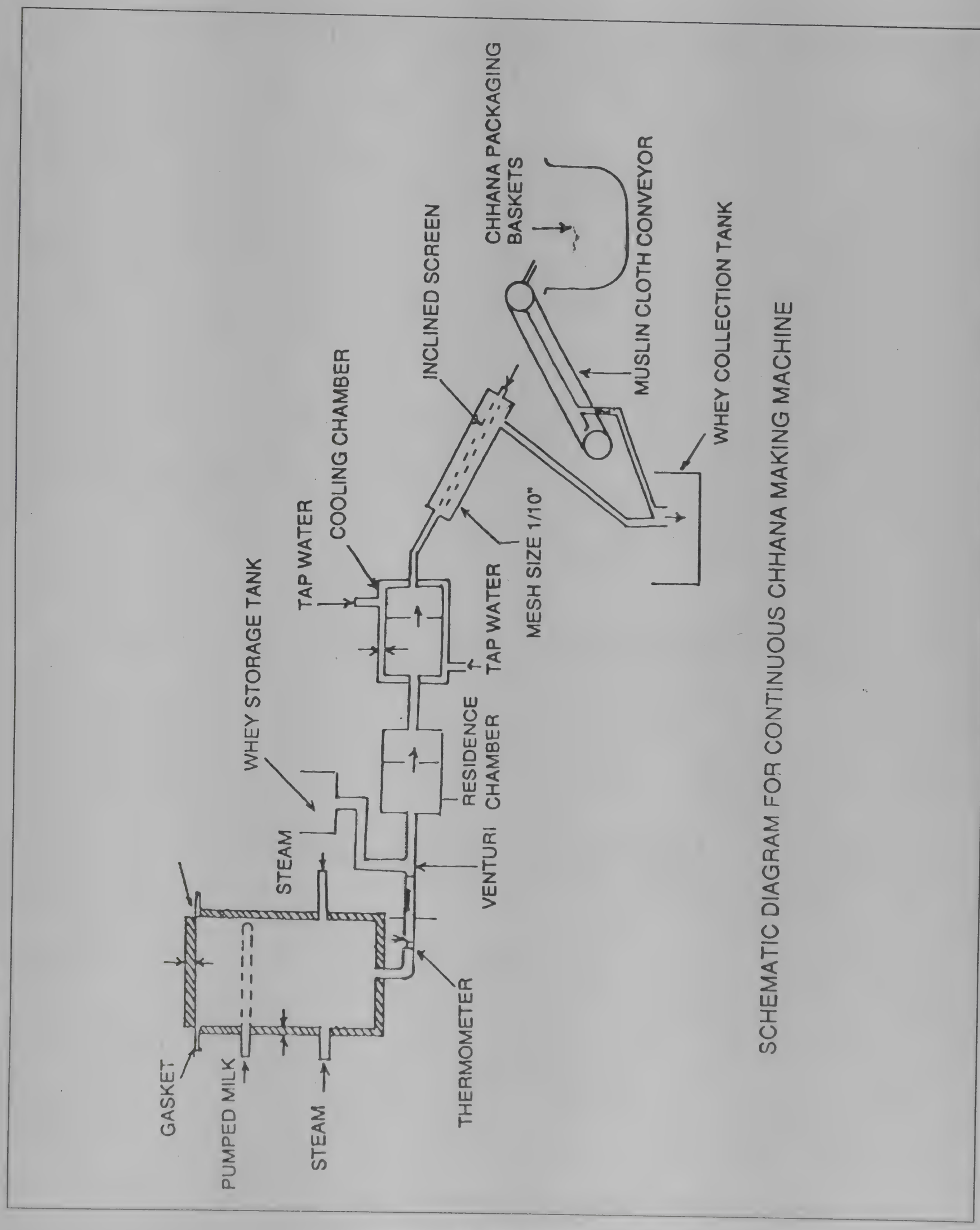
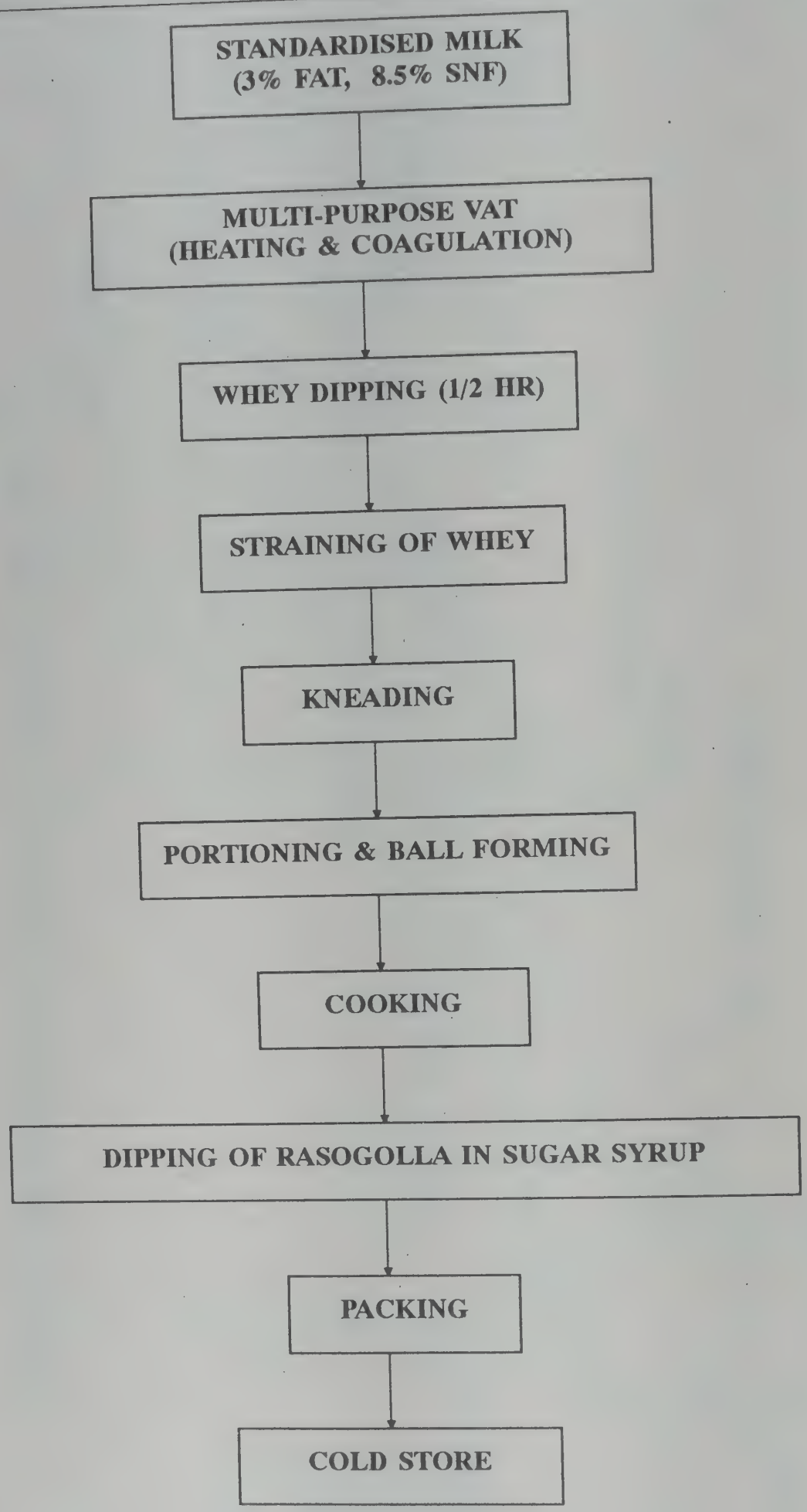

WHEY STORAGE TANK
TAP WATER
COOLING CHAMBER
INCLINED SCREEN
CHHANA PACKAGING BASKETS
MUSLIN CLOTH CONVEYOR
WHEY COLLECTION TANK
TAP WATER
MESH SIZE 1/10"
GASKET
PUMPED MILK
STEAM
WHEY
STEAM
RESIDENCE CHAMBER
VENTURI
THERMOMETER
SCHEMATIC DIAGRAM FOR CONTINUOUS CHHANA MAKING MACHINE

Figure-9



FLOW DIAGRAM FOR MANUFACTURE OF RASOGOLLA

Figure-10

TABLE-1 PHYSICO-CHEMICAL CHARACTERISTICS OF KHOA PREPARED BY DIFFERENT MECHANISED SYSTEMS

Characteristics	Mean value ± SD			
	ISSHE (12)	Conical vat (6)	Convapcontherm (4)	Roller (3)
Total Solids (%)	65.63+ 2.19	63.14+ 3.44	63.76+ 6.50	70.96+ 2.58
Fat (%)	21.97+ 2.13	21.15+ 1.21	21.50+ 1.60	27.75+ 1.25
Free fat (% of total fat)	35.00+ 5.70	43.53+ 10.24	58.37+ 9.32	51.15+ 2.62
Acidity (%)	0.53+ 0.03	0.54+ 0.07	0.61+ 0.08	0.58+ 0.01
pH	6.35+ 0.06	6.38+ 0.05	6.35+ 0.04	6.22+ 0.02
Colour (Lovibond tintometer readings)	1.61Y (1.4Y to 2.5Y)*	1.68Y+ 0.3R (1.3Y to 2.6Y+ IR)*	2.03Y+ 0.5R (1.5Y to 3Y+ IR)*	1.5Y (1.4Y to 1.6Y)*

Figures in brackets indicate the numbers on which mean values are based.
* indicates the range of colour.

TABLE-2 SENSORY PROPERTIES OF KHOA PREPARED BY DIFFERENT MECHANISED SYSTEMS

Process	Mean sensory scores			Criticism
	Flavour (50)	Body and Texture (35)	Colour and appearance (15)	Total score (100)	
ISSHE	48	32	14	94	No criticism
Concial wat	40	22	10	10	72 Lacks typical khoa falvour, sticky, lumpy, pasty, burnt particles, slicing characteristics, lacks grainy texture, uneven colour
Contherm convap	38	24	9	71	Same as above, but no lumps
Roller	45	29	12	86	Mild Khoa flavour, lacks grains, presence of hard flakes (nodules)

	score	grade of product
	90 and above	Excellent
	80-89	Good
	60-69	Fair
	60 and below	Poor

TABLE-3 RHEOLOGICAL PROPERTIES OF KHOA (AT 20°C) PREPARED BY DIFFERENT MECHANISED SYSTEMS

Properties	ISSHE	Concial vat	Contherm convap	Roller
Hardness (mN)	47.46	58.09	52.01	89.67
Cohesiveness	0.512	0.450	0.434	0.406
Adhesive Force (mN)	0.268	0.662	0.757	0.465
Springiness (mm)	4.80	7.33	8.00	6.16
Gumminess (mN)	29.29	26.04	22.57	36.40
Chewiness (mm.mN)	116.42	191.20	181.06	223.97

Mean values are based on three readings

TABLE-4 OPERATIONAL FEATURES OF THE DIFFERENT MECHANISED SYSTEMS OF KHOA MAKING

	Features	ISSHE	Conical vat	Conthermconvap	Roller
1.	Type of Feed required	(Conc. milk (>40% TS)	(Conc. milk (>35% TS)	(Conc. milk (>35% TS)	(Conc. milk (>50% TS)
2.	Continuous/batch process	Continuous	Batch	Continuous	Continuous
3.	Moisture evaporation cap. (L/hr)	20	75	150	20
4.	Scaling up possibilities	Yes	No	No	Yes
5.	Quality of product throughout the run	Uniform	Uneven	Uneven	Uneven
6.	Possibilities of controlling quality attributes	Good	Poor	Poor	Fair
7.	Losses of milk solids	Minimum	high	Moderate	Moderate
8.	Automation possibilities	Yes	No	Yes	Difficult
9.	Manpower requirements (persons)	1	2	2	2
10.	CIP Cleaning	Yes	Difficult	Yes	Difficult
11.	Exposure of product to environment during manufacture	No	Yes	No	Yes
12.	Approximate area required (L X W X H in meters)	3 x 1 1/2 x 2	3 x 3 x 4	4 x 4 x 8	2 x 2 x 4
13.	Safety	Most safe	Need care	Need max. care	safe
14.	Operational simplicity	Simple	Difficult	Difficult	Manageable

Non-milk Based Indian Sweets

R A. Radhakrishnan *

Traditionally in India, we have lot of non-milk based sweets which are very popular and in each region there are different kind of non- milk based sweets prepared by the local population based on the agriculture produce of that region. With the movement of population from one region to another in search of job opportunities and inter-caste marriages becoming very common, these regional sweets have become popular all over the country. To name a few sweets :

- Rave sajjige (wheat semolina sweet)
- Jahangir (blackgram sweet)
- Coconut burfi
- Badam halwa
- Bombay halwa
- Groundnut cake (chikki)

At present, many of these products are available in sweet-meat shops and are mainly manufactured by unorganised sector. I would like to point out certain deficiencies in this sector.

- ➤ Most of the products are made in un-hygienic condition. They have total apathy towards health hazards in terms of colour they use, the raw material and the manufacturing location.
- ➤ The storing of finished products in shop is also very bad. In most of the sweet-meat stalls we find lot of flies and other insects
- ➤ In certain shops where the products are displayed and stored conforming to hygiene requirement, the price of the products is very high and can cater to only high income group.
- ➤ On the other hand, there are lot of vendors selling these sweet at public places like bus-stand, railway stations etc. they are fairly low priced but affects the health of people who consume them.

There is very good possibility of giving these products the same treatment as it happened in case of Gulab Jamoon i.e. earlier Gulab Jamoon was only made by professional cooks or it was a bought out item from the sweet-meat shops. The arrival of Jamoon mix has changed the scenario and now every one make Jamoon out of instant mix. It is in this context that I would like to bring to notice certain changes which are taking place in the Indian consumer behaviour. Earlier in good-old days, all sweet were made only at home, when ladies of the houses had lot of time and patience plus the attitude was that everything should be made at home. With modernisation, fast pace of life and exposure to the western culture as well as breaking up of joint family system to individual family groups, time for cooking has taken a back seat. In most of the urban and semi-urban areas, both husband and wife are engaged in either professional or social activities. They have little time for cooking plus many of the women have not learnt the traditional way of making the sweets which are fairly tough. Hence, there is a good possibility if we can give these products in either intermediate from like instant

ORKAY Instant Foods, VV Puram, Bangalore - 560 004.

mixes or in retortable packing i.e., in ready to heat & eat form or by packing in thermoformed PVC i.e., ready to heat concept. But this kind of products suffers from the following disadvantages:

- The price of the product becomes fairly high due to taxation which works out to nearly 40% to 50% of the product cost.
- Nearly 50% to 100% is the marketing cost which includes distribution and promotion.
- When it comes to price verses hygiene, the middle income, lower income groups as well as rural market are ready to sacrifice the hygiene. It is very necessary that while marketing these products, rural market which nearly consumes 50% to 60% of the total consumption of these product is not neglected.

In view of above, my suggestions are :

- In order to see that these products become very competitive and affordable by everyone. the government should reduce the taxes for various input which go into manufacture of these products i.e. on machinery, packing material and raw- material.
- Cheaper and indigenous technology to be developed by our scientific organisations.
- A concentrated and co-operative effort both by the government and industry in bringing awareness about hygiene versus cost versus health. Something on the lines of what the Egg-Promotion Association has done.

Problems Faced by Indian Non Milk Sweets Industry

N.B.Chitale

In India sweets making industry is developing very fast. Sweets and savouries are manufactured by few big factories in organised sector and majority of sweets & savouries are manufactured by small and medium size Mithaiwales all over country.

Sweets are two types :

- Milk Based Sweets

  Pedha, Burphi, Rassogollas, Gulabjamun etc.

- Non Milk Based Sweets

  Laddus, Balushai, Jeelebi, Sohan Papdi, Karanji, Puran Poli, Halwa, Sutarfeni etc.

In every sweetmeat shop sweets, salted savouries are also available like Samosa, Chivda, Pharsan etc. The sale of salty snacks is increasing day by day and it is now about 40 to 50% of total turnover in the market.

Popular kinds of Non-milk sweets

- Laddu

  Motichure or Bundi, Besan Laddu, Mysore Pak.

  Raw material required include Gramdal flour, Frying medium i.e. Pure Ghee, or Vanaspati or Refined Groundnut Oil etc. Sugar, some flavouring agent i.e essence or Cardmom or Saffron and some nuts.

- Rava Laddu

  Soji or Rava from wheat, Sugar and Flavours, Kismis, Cashewnuts etc.

- Jelebi

  In Maharashtra and in all Northern India, Wheat flour is mixed with some Butter milk and water and is kept for 24 hrs. In some areas this is done out of Rice.

- Balushai

  It is made from wheat flour Maida, Vegetable Oil, some flour raising agent i.e., Baking Powder etc. Sugar and flavour.

- Sohan Papdi

  It is made from Maida, Gram flours, Pure Ghee or Vegetable Oil, some Flavour, Cashewnuts or Almond Pista etc.

- Karanji, Kanola

  This sweet is generally sold on festival occasion i.e. Diwali, Chrismas, and also served Marriages on. It requires Soji or Rava, Maida, Vegetable Oil or Pure Ghee, Coconut powder, fresh or dried, Sugar, Khuskhus and Flavours.

- Puran Poli

  This Western Indian delicacy is now becoming popular all over India. It requires Chana Dal, Gur, or Sugar, Wheat flour, some Cardmom or Jaifal flavour.

*Partner, Chitale Bandhu Mithaiwale, Pune-411 030

- Halwa

  Badam Halwa, Sohan Halwa, Mahim Halwa. Raw materials include Maize starch, Vegetable oil or pure Ghee, Nuts, Flavours, Colour etc.

- Sutarfeni

  It is made from Maida and Oil. Fried, soaked in Sugar syrup followed by addition of Rose Flavour. Many people use unsweetened sutarfeni in sweet milk for consumption

Quality of raw material

There is no grade specified on the bag of Maida or Gram Dal. Only in case of Vegetable Oil all specifications are furnished. When a sweetmeat manufacturer goes to market to purchase raw material like Maida, Dal, he has to use his own judgement to select the best raw material. The raw materials are not graded properly. We provide some specification for purchase of Maida, and Vegetable oil as under

Maida is of 3 types

- ➢ Gluten 7% - Biscuit Flour
- ➢ Gluten 9% - Breads Flour
- ➢ Gluten 11 to 12% - Super Quality

Alcoholic Acidity determines quality of Maida. Sometimes wheat flour is manufactured from wheat which is damaged or infested with weevils or moisture. This variation in Maida affects final product.

- Besan

  Pure Besan is manufactured from Chana Dal. Other inferior variety is available called as Pakoda Mix, which contain Maize and Peas along with Chana Dal. Texture of Besan differs because of presence of this foreign matter.

- Vanaspati

  Number of brands are available in market. The quality depend on the type of oil used i.e. Groundnut Oil, Til Oil, Sunflower, Kardi, Soyabean Oil.

Need for Equipment to Produce Sweets

The entire sweets industry is unorganised. There are hundred of sweetmakers and sweetmarts in every city, town and also in villages.

Many sweets are prepared daily and served fresh in the shop itself. Fro instance, hot Jelebi and Milk or Jelebi with Phapda as is the practice in Gujarat, Rajastan and in Northern States.

The demand for sweets varies from day to day and from season to season.

On festival occassion the demand goes up 20 times that of daily sale and in such situations it is difficult for manufacturers to cope up with demand and hence there is need to increase the capacity of machines to produce sweets.

If a manufacturer / shop-keeper gets an order of 20000 pieces of Bundi Laddu to be supplied within 2 days or 3 days with the existing staff he has, it is difficult for him to give fresh stuff at short notice. He has to manufacture 5 days in advance leading to deterioration in the quality of sweets. Hence there is utmost need to have at least semi-automation of manufacture of Bundi from Gram Dal and Round Laddus an then be made by hand . So if this sweet making industry has to be modernised there is definite scope for designers to introduce such machines.

In this gathering of leading experts on Indian Sweets Industry from all over India, I request on behalf of all sweet manufacturers to develop appropriate machinery to help us produce sweets in large scale, in an economical and hygenic manner.

Packing of Sweets

In India the aspect of packing is very much neglected because there are no big manufacturers who can produce sweets in large scale for packing and sale all over India or Abroad. In case of many food stuffs such as Potato wafer, Sugar Boiled sweets Toffees, Biscuits & Cakes are packing marketing all over India is quite common.

Efforts are needed to find out suitable packing machinery & material to pack Laddus, Balushai, Mysore Pak, Sohan Papdi etc. So that these

packings, even when opened after 15 to 20 days remian fresh as on the 1st day of manufacture.

Energy sources

Generally all sweets are made on Hard Coke Bhatties, Petroleum Gas burners and Diesel Burner Bhatties.

Different sweets require different degree of heat For Jelebi and for Balushai slow firing is needed while for frying of Bundi and for making sugar syrup, intense heat is required.

Making of Sweets on Diesel Bhatties and Hard Coke Bhatties is many times dangerous and chances of fire are frequent.

Hard Coke is the cheapest medium of energy and Petroleum Gas is the costliest medium of energy.

Electricity is not available in plenty and hence electrical source of energy is not considered. In many foreign countries electrical energy is used for heating and frying and many automatic controls are used to regulate heating resulting in saving in energy cost.

We have tried in our factory thermic fluid boilers to heat oil and we feel the oil temperature can be controlled precisely and the fire hazard is minimum. The Chimney will take care of Boiler fumes and the area in which frying is done could be kept clean.

At present cost of energy is as follows:

		– Present rate in Pune
Hard Coke	–	Rs. 3.04 per kg
Diesel	–	Rs. 7.32 per Ltr
Gas	–	Rs.310 per 19 kgs or Rs. 16.31 per kg

Hygiene and sanitation Aspects

Large numnber of sweetmeat makers are in small scale sector. They do not have necessary clean environment, sufficient space to store raw material or clean water and as such the quality of product may not be as it should have been.

In our country general level of cleanliness is very poor as compared to developed countries. Our habits of chewing pan and tobacco and spitting anywhere are detrimental to clean environment. Our dust bins are empty and all gardbage is thrown not inside but by the side of dustbin. I have listed some of the causes of general uncleanliness.

Manufacturers should try to overcome these short comings and give to their customers the best, i.e. clean food.

Malpractices in this trade

Generally to lower costs some of the manufacturers buy Maida, Chana Dal of Inferior quality. Some use Cotton seed oil in place of Groundnut or Refined Oil. If the raw material is of highest quality chances of getting good product are definetly more.

Other than these, I personally feel there are no more malpractices in this trade.

In general, we observe that many small and medium manufacturers do not keep their accounts properly and so costing is not done correctly. But this practice is detrimental to trade. With proper accounts you will have to pay Sales Tax and if income is more, then Income Tax also. With payment of taxes honestly he can keep his conscience O.K. Lastly though not related to Non Milk Sweets but related to sweets trade in general, Government of India proposes to adopt certain new standards under PFA Act for Pedha, Burphi etc.

We give below some of the prescribed standard

- Khova Burphi

T.S.	–	85
Fat	–	12.5 Dry Weight
Sucrose	–	40% Maximum
Ash	–	3%

- Rabdi (Basundi)

T.S.	–	45% Sugar free base
T.S.	–	18% on Sugar base
Fat	–	10%
Sucrose	–	20%
Ash	–	2%

We do understand that in the interest of Public health, we should manufacture clean and unadultered sweets.

But when Central Government specifies that this much sugar only to be added & this should be the fat and protein etc, then this becomes tool in the hands of food inspector to harass small manufacturers.

If Burphi is to be prepared, then it is supposed to be made only of Khova, Sugar and flavour. It should not have Maida in it. If Maida is added then only it should be treated as adulterated. In South it is always pronounced as Dudh Pedha. It specifically means Pedha manufactured out of milk only.

Many people may like less or more sugar or less or more fat, then what interest of public is guarded in specifying particular Fat % or Sugar %. In every Mithai shop different varities of Pedhas are kept. Pedha with more sugar, medium sugar and less sugar. Central Governments would not change the habits of people under PFA Act In foreign countries low calorie Ice Cream, Coca Cola etc. are introduced. So those who want less fat can go for that. But our Government wants everybody should eat as per Government orders, hence common man has no choice.

So we should pass a resolution in requesting Government to have negative standard system. It clearly means Burphi should not contain Maida or any undesirable raw material, it should be hygenic.

In Sweets Industry preservatives are not allowed as yet. They should be permitted and shopkeeper should exibit on the package what preservatives are used. Preservatives are allowed in many foods so why not in sweets. Shelflife of sweets will definetly increase with the use of preservatives.

Recent Advances/Innovations in the Manufacture of Sugar Based Confectionery

S. N. Raghavendra Rao *

Introduction

Mankind has an inborn love for a sweet taste and this had led to the development of variety of confectionery products with a high sugar content. Its birth was coincident with the discovery by man the sweetness of honey and the confectionery products are with us from time immemorial. In fact our forefathers even before 1400 AD have standardized the preparation of so many varieties of sweets. Indian confectionery occupy a privileged place in our social customs having wide varieties of products. Since the work on Indian confectionery is very meagre, author tries to project some of the recent work/innovation in the field of sugar based confections.

Indian Confectionery

Indian confectionery may be considered under two categories - Traditional confections where certain products are deep fat fried eg. Gulab Jamun, Jelebi, Jahangir, Boondi, Bhalusa, etc. Peda, Burfi, Sandesh, etc. are those products where the fat is derived from the ingredient itself and in third type of products like Mysorepak, Sohne Halwa and Sohne Papadi, the fat the added to the ingredients. The other category of confection is the western type eg., cakes, chocolates, etc. From the angle of physical form many of the traditional products are - solid, semi solid and solid in liquid form with variation in moisture from 10% (Mysorepak) to as high as 35% (Shrikand). Sugar content - is invariably high ranging from 35 to 55%.

Raw Materials

The principal Raw Materials used in Indian confectionery are Sugar, Fat, Chhana (casein), Khoa (evaporated milk), Pulse meal, Wheat flour, Soji, Coloring and flavoring materials, Nuts, etc. Traditional Indian confectionery are essentially cottage or home scale operations. Manufacture is spread over the entire country. Data on the quantity and value of total production are not available. A few figures of raw material conversion through survey has revealed that out of 60 million tonnes of milk produced in the country, nearly 50% is converted into various products like butter, ghee, milk powder, cream, khoa, cottage cheese and confectionery products like chocolates, etc. It is also reported that about 5 lakh tonnes of khoa which is an important ingredient of many sweets worth Rs. 435 crores is produced annually.

It has been reported that in Bombay alone there are about 700-750 sweetmeat manufacturers with an annual turn over of about Rs. 100-125 crores. In Baroda, about 500 tonnes of Shrikand (Milk sweet) is consumed annually. In Mysore alone, nearly 500-600 bags of sugar is used daily for sweet preparation. In Calcutta, sweets worth Rs. 200 crores are being sold per month. By the above data one can imagine the magnitude of Indian confectionery industry in the country.

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Typical Indian sweets prepared in the country are as follows:

Based on Khoa

Name	–	Region
Burfi	–	All over India
Peda	–	All over India
Gulab Jamun	–	South India
Kalakhand	–	North India

Based on Chhana

Sandesh	–	Bengal
Rasagolla	–	Bengal
Rasamalai	–	Bengal, Bihar, Orissa
Chamcham	–	Bengal, Bihar

General Sweets

Nut Burfi	–	All over India
Shrikand	–	Maharashtra
Sohnne Halwa & Papdi	–	North India
Laddo	–	All over India
Jelebi	–	All over India
Balusha	–	Gujarat
Boondi	–	All over India
Mysorepak	–	South India

Production of raw materials in the country in 1991-92

Sugar	–	1.2 million tonnes
Vanaspati	–	1.0 - 1.2 lakh tonnes
Jaggery	–	10 -12 lakh tonnes
Liquid glucose	–	45 - 50 thousand tonnes
Dextrose	–	14 - 15 thousand tonnes
Anhydrous dextrose	–	about 2000 tonnes

The last three items are mostly used in western type of confectionery.

Functional Properties of the Ingredients

Sugar and fat are the most important ingredients which plays major role in different types of products and the proportion of which controls the texture, taste of Indian confection.

The role of sugar is mainly in imparting sweet taste, mouth appeal and to a some extent calories. It also acts as filler in the product. But the functional property is very important in getting or altering the organoleptic quality of any product.

Role of Fat In Traditional Indian Confection

The choice of fat in Indian confectionery is mostly to ghee. But with the advent of hydrogenation industry the vanaspati has almost replaced the ghee because of its cheapness and regular availability throughout the country, all year round. Vanaspati is bland in nature so it is amenable to characteristics and selective flavoring for each food item.

Fat plays an important role in the manufacture of sweet products, viz.

- ➤ modifies the texture of a confection
- ➤ has got an aerating property (only the fat has this functional property)
- ➤ lubricates the ingredients and improves the overall eating qualities by moisturization and tenderness.

These descriptions represent only a generalized function of a fat. For Indian confection specific information is required for various products involving different sources of starch & protein. For all confectionery fats there are three basic requirements:

- clean and sharp reaching melting point at approximately body temperature
- stability to all types of rancidity and
- some physical properties which do not detract from the textural requirements of the final product.

The main draw backs in the Indian confection using ghee or vanaspati are - they cannot be marketed during summer months due to fat seepage and loss of texture. Little is known about

the functional property of fat used in Indian confections and this is where work is needed to develop tailored made fats in the preparation of a confection to suit the tropical climate of India.

Mention may be made in this connection to the work carried out at CFTRI in studying the functional property of fat used in Mysorepak, Sohne Halwa and Papdi and also the department of Chemical Technology, University of Bombay, CFTRI and Hindustan Lever on the work carried out on the fractionisation of fat from sal, mango kernel and kokum with good functional property.

Improving Product Quality and Storability

Indian sweets are mostly catered without - packing and are mostly semi preserves. Loss of flavor, staleness, rancidity, discoloration, change of texture (surface solidification of fat) seepage of oil, sugar - crystallization and microbial spoilage are some of the factors that limit the shelf life or appeal of Indian confections. According to the market survey and analysis of sweetmeats available in the country, these products could be grouped into products having different moisture content ranging from 1% to above 20% and having different fat content ranging from 5% to above 25%.

Existing Technology

Today industrial production of certain products are limited because of poor shelf life. More work is needed to streamline the process and scaling up and also ensuring good shelf-life.

Urbanization and Export of Indian Confection

A meagre quantity of about Rs. 10 lakhs worth Indian Confections are exported to 13 countries and it is expected to improve much. There is growing demand for Indian sweets within the country itself due to urbanization, industrialization, space, time and energy problems, etc. The traditional small scale or home scale manufacturers are not able to meet the demand. There is an immediate need for standardization of the operation for large scale handling, quality control, proper packing, etc. It may not be necessary to completely mechanize the process but an optimum upscaling of unit operations is necessary through more consistent efforts on scientific lines.

Improvement in Technology/Innovations

Modern technology has played an important role in some of the products like rasagolla, gulab jamun, jelebi, jahangir, etc. Rasagolla and jamun could be prepared on a large scale in a streamlined manner and also can be packed in cans with good shelf-life and quality. Instant ready to use mixes in a dry powder form with a very good consumer acceptance and shelf-life have been developed and commercialised by CFTRI for Jamun, Jelebi, Jahangir, etc. Khoa making machine with a capacity of 50 litres of milk per hour and an industrial process for the manufacture of shrikand have been developed by National Dairy Research Institute of Karnal and Baroda. Work at CFTRI has shown that the shelf life of Sohne Halwa and Papadi could be extended under ambient conditions of storage with the addition of antioxidants and proper packaging. Addition of sorbic acid has been very useful against spoilage with respect to Burfi. Seepage of fat and loss of texture during summer months has been contained by using emulsifiers or fat having higher slip point (42°C) or solid fat index of about 20% at 37°C.

Need for more R & D

Recipes give only a general guide lines but actual preparation is rather an art. A comprehensive R & D is very important and an urgent need to extend the shelf life of Indian confections. basic investigations in the area of Indian confection is almost negligible and a thorough study is needed and should be tackled from different angles. With the ever increasing demand of Indian confections in the country and to a reasonable extent abroad, it is high time that the Industry should move from being an art based to a science based using modern principles of Science and Technology.

With Best Compliments from :

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Speciality Fats and Refined Oils
"Roles and Applications in Flour Confectionery"

*Sudhakar Gupta**

Introduction

Fats and oils occur naturally in a wide range of sources. There are many varieties of oil bearing seeds in the world but only twenty two such seeds are commercially developed on a large scale and twelve of them constitute more than 95% of world's vegetable oil production. This class includes such as cotton seed, groundnut, rapeseed, safflowers, seasam, soybean and sunflower etc. (See Table 1.)

Table 1. Oil Contents of Important Sources

(Seeds from Dicotyledons)	
Source	Oil %
Cotton Seed	18 - 20
Groundnut	45 - 50
Rapeseed	40 - 45
Seasam	50 - 55
Soybean	18 - 20
Sunflower	30 - 45
Trees Fruits	
Coconut	65 - 68
Palm Fruit	45 - 50
Palm Kernel	45 - 50
Babassu	60 - 65

Some amount of edible fats and oil is also available from animal source such as butter, lard, tallow and from marine source such as whales, shark, but these are not used as components of bakery products.

The terms fats and oils are often used interchangibly and may be a cause of confusion. Simply put "Refincd Oils as one or combination Hydrogenated are known as Fats (Vanaspati)."

Specialised Fats

- Definition :

The Fats with value addition in form of controlled melting characteristic, increased storage stability, aerated for good volume, emulsified for liquid absorption and specified quality standards is termed as speciality Fats.

- Requirement :

The Fats with specified value addition are made depending on End usage as Puff Pastry, Biscuits, Cakes and Cream etc. Unlike cooking fats, during the various process of Baking the fat has to behave differently at different temperatures of application which gives us the profile (D-Profile) or a curve depecting melting characteristics.

This curve is very signified as one of the quality control procedures to decide the value of fat against what is required of it.

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Let us examine the specialised fats more in detail.

- Role of Specialised fats in Bakery Foods :

  The specialised fats and refined oils perform a number of desirable functions in bakery foods, such as:

  - Imparting tenderness
  - Structural contribution/ Air incorporation
  - Lubrication
  - Moisture mouth feel
  - Heat transfer

The desired properties for optimum performance in a fat or oil are based on the factor: the ratio of solid to liquid phase. The terminology defining these properties are:

- Hardness
- Plasticity
- Homogenity
- Melting Behaviour
- Stickiness
- Melting point etc

The specific function and role of specialised fats is discussed along with application in details in the following text.

Puff Pastry

The principle underlying the preparation of Puff Pastry is the inter leaving of thin layers of fat with thin layers of dough so that upon baking, a separation of dough strata occurs. The individuals dough layers contain no leavening and undergo very little expansion during baking, water vapour which is generated between the layers causes a puffing effect, steam is trapped in pockets formed by fusion of dough layers.

- Role of Fat :

  The fat, to withstand the heat generated during rolling and to retain the structure till the baking is complete, will depend on following characteristics vis-a-vis benefits.

  - Hardness/Tough Texture :
    The fat will not ooze out during lamination.
  - High Plasticity/Homogenity :
    During lamination the fat will spread evenly either by mechanical press or hand.
  - Non Sticky :
    It will help in lamination as the fat will retain its firmness.

- Application :
  - Turn overs
  - Millefauilles
  - Volauvents
  - Napoleans
  - Stuffed Puffs
  - Khara Biscuits

Biscuit Fat

Fats are probably the most important ingredients used in biscuit manufacture as they are the third largest components after flour and sugar, considerably more expensive. The prime requirement is a biscuit with a smooth surface which has shine and an open texture giving a delicate bite.

- Role of Biscuit Fat :
  - In dough they perform shortening and textural function so the biscuits are less hard than they would be without them.
  - They also contribute to cookies/Biscuits processing and quality.
  - If fat level is higher, then lubricating function in the dough is so pronounced that little water is required to achieve a desired consistency, little gluten is formed and starch swelling and gelatinisation is also reduced giving a soft texture.
  - For sheeted cookies, the contribution is in terms of tender eating quality.
  - In some recipes where sugar is high, the fat combines in the oven with the syrupy solution preventing it from setting to a hard vitreaus mass on cooling.
  - The aerated biscuit fat gives a better shortening effect as dispersability of fat

and flour is improved. The volume of the biscuits also improves.

- The fat with addition of antioxidants is used to retard the onset of oxidative rancidity after baking of biscuits.

- Application :
  - Cream Wafer : The fat which is used in the dough should be soft and in cracker dust should be hard with less shortening properties as the fat contributes to the tenderness and helps in oven spring of crackers.
  - Marrie / Rich Tea / Gem

Cake Margarine

- Role of Fats in Cakes :

  The Margarine is a substitute of butter made with hydrogenated oil in aqueous phase bonded with emulsifiers to give a fat better
  - Stability against whipping
  - Maintain the tenderness in cake for a longer time
  - Cake does not give any greasy feel after consumption
  - It results in more tender, soft and melt in mouth cake.
- Application :
  - All cakes which has butter as a base.
  - Some baker, because of melting characteristics, use in the butter creams.
  - Danish Pastries.

Cream Fat

The cream based cakes and pastries are made with sponge, sugar syrup and creams (Butter, Fresh, Fat Based) with an option of using nuts and fruits.

The cream made out of butter is commercially not viable for majority of bakers, Fresh cream because of low shelf life. This gives way to have a specialised fat for cream fillers which adds to overall visual and taste appeal and can therefore entice customer into buying.

- Role of Fat in Cream filler :
  - It is whiter in colour so takes on any bakery colour.
  - It is aerated so when whipped with sugar results in good volume and provides a fluffy texture.
  - It is having a low SMP so releases all flavours on consumption and does not have any greasy mouth feel.
  - The fat contains antioxidants so gives a better stability.
  - The filling made out of this fat remain firm at room temperature so it does not slide when eaten.
- Application :

  Creams for Cakes, Pastries
  Filling for sugar wafers or sandwitch cookies.

Cake and Icing Shortening

- Role :

  This shortening with high melting point allows a baker to use a higher ratio of sugar to flour and other liquid ingredients in the recipes, without affecting the adequate aeration of batter during mixing.
- Results in End Product :

  It results in sweeter, more moist, lighter and finer textured cakes.
- Application :

  In Bar Cakes / Slab Cakes / Fruit Cakes / Cup Cakes.

Spray Fats for Crackers

- Role :

  This fat provides
  - A glossy surface appearance.
  - Improves the eating quality.
- Qualities of Fat Required :
  - Good oxidative stability because of large food area covered.
  - Low melting point to avoid a waxy or greasy mouth feel and a dull surface.

- Application :
  - Snack wafers
- Fat Available :
  - Coconut Oil / Partially hydrogenated soybean oil.

Pan Release Emulsion

- Role of Refined Oil in Pan Release :
  - Easy detection of application areas.
  - Does not produce fumes/smoke during baking.
  - Easy release of loaf from the mould after baking.
  - Does not impart any odour to the loaf.
  - Suitable for manual/spray application.
  - Remains pourable over wide temperature range.
- Application:
  - In all varieties of Bread Moulds.

Coating fat

Cookies and other confectionery items are frequently coated with chocolate. The SFI profile of cocoa butter is unique among natural fats, being very light at room temperature but melting rather sharply and completely at about 32 - 35° C. This characteristic is accepted as the norm for coating fats. The substitute for cocoa butter is based a fractionated palm kernel oil, soy and similar vegetable oil which have been specially hydrogenated and are called Hard Butter.

- Role of Hard Butter :
  - It does not melt at higher temperatures and has an advantage over chocolate.
  - The tempering of hard butter is much easier and less complex in their crystal habit.
- Application :
  - Confectionery coating.
- Precautions in Using Specialised fats :
  - Must always use the right fat for a particular product. If fats are interchanged, end use product performance is clearly sub- optimal.
  - All product properties are ideal at application temperature. The product must not be stored near ovens, direct sun, hot rooms etc.
  - Never melt a specialised fat to remove it from the tin: else practically all its physical properties are lost.
- Overall Advantages of Using Specialised Fats :
  - As these fats are designed to improve quality of the baked product, for specific applications, there is a marked improvement in the quality of the baked goods.
  - Better quality bakery products lead to better customer satisfaction: So important in these competitive days.
  - Customer loyalty leads to word-of-mouth publicity which attracts more customers.
  - This results in increased sales.
  - Increased sales results in increased profits: obviously a happy state of affairs to be in.
- Technical Aspects of Specialised Fats :

Certain properties of specialised shortening are of particular importance to Baker. The Solid Fat Index, plasticity and oxidative stability of shortening are determined by production process.

- Relation of the Factors in Shortening Functionality
  - SFI (Solid Fat Index) : It relates to the percent of shortening which is solid at various temperatures. The curve depicts the properties of the shortening at different temperature.
  - Plasticity : It is defined operationally, the shortening is smooth, not grainy, deforming readily when squeezed but holding its shape when set on a flat surface. The penetration test is conducted to check degree of softness/hardness.
  - Oxidative Stability : The type of fat of oil used will have to have same oxidative stability in regard to what they have been used for either bread or deepfried snack.

Food Packaging

A.N.Srivatsa *

There had been always a tendency amongst technologists, economists and managers, that packaging was something that had to be dealt with as economically as possible.

The food that man produces, has may competitors, namely rodents, insects and microorganisms. In addition to these, food deteriorates by chemical, enzymatic and physical factors. Hence prevention of waste and provision of food which is safe and good is the paramount duty of all concerned with food.

All the spectacular achievement in the field of science and technology, have always been of military origin. From gunpowder to aeronautics and space, it is the urge of any particular nation/society to be superior, that has catalysed all the progress to man.

At the beginning of nineteenth century, Napolean's concern of providing for the Armies, especially after the scorched earth policies of its adventure resulted in the "canning" process by Nicolas Appert.

Hence the basic principles that

- food must be available wherever there are people and not where it is grown/produced
- must be available all the year and
- must be very convenient to purchase and use, are evolved.

This essentially means that food should be properly and adequately packaged. Packaging provides a coordinated system for transport, distribution and storage and also serves as a means of ensuring safe delivery to the ultimate consumer in sound condition at minimum cost.

Packaging is dynamic and is constantly changing. New materials, new method and new machinery produce increasingly more functional and scientific packaging.

To design an efficient packaging for food the following facts are required

- the nature of the product-the materials from which it is produced and manner of chemical and biological deterioration.
- physical shape and state, size, density and
- compatibility

Packaging Materials

Traditional packaging systems based on metal, wood and glass have been long used for packing various types of foods. However, due to the dwindling resources, forests and tin ores, packaging systems based on flexible polymeric materials together with or without metals are found to be very attractive. Flexible packaging systems cost 20% of that of glass, 33.33% of that of metal containers and 50% of composite cans.

Hence plastic/polymeric films either in single layer or in multiple layer have become a major packaging system.

Until 1950, the production of polymeric films was very much limited In 1950, a satisfactory low density polyethylene (LDPE) was extruded, challenging the dominance of regenerated cellulose, popularly known as cellophane. Though it could not be heat sealed without appropriate coating, it had been dominating the decorative purposes.

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LDPE does not have the tensile strength and stiffness of cellophane. Its heat sealability, flexibility and toughness have made it very attractive for number of users.

The biggest break through came with the entry of polypropylene. PP has a better transparency than glass and, twice the tensile strength and better heat resistance. This has permitted its use in retortable pouches either singly or as a laminate. The other important packaging materials can be viewed between these two popular films.

High Density Polyethylene (HDPE)

With its higher density and higher crystallinity, the properties of HDPE are slightly different from LDPE. Tensile strength and stiffness are higher, elongation is low and haze is very high and the film is translucent to opaque. HDPE can be successfully used where clarity is not required or desirable.

Linear Low Density Polyethylene (LLDPE)

LLDPE is polymerised under low pressure and it has low temperature stability. LLDPE films have great resistance to puncture and high tensile strength even in thinner films. This has posed as a challenge to the conventional LDPE.

Ethylene-vinyl acetate copolymers (EVA)

Relative to LDPE, EVA copolymer have greater elongation, high impact strength but with lower barrier properties.

Ionomers

Ionomers are flexible tough materials with extremely good clarity. They are used in coextruded films because of their grease resistance and ability to seal at low temperatures

Vinyls

The most common vinyl is the polyvinyl chloride (PVC). Unplasticised PVC is stiff and is tough. Plasticization improves the low temperature properties and renders it soft. Thin plasticed PVC is widely used for food packaging purposes.

Polyesters

Polyester film is very tough and strong and has a high melting point. Polyester film can be used for vacuum packaging of meat (for short periods); but in-bag products and for metallising

Nylons

Nylons have very higher tensile strength and high softening points. Nylons have high water vapour permeability but are very good gas barriers especially against oxygen.

Poly Carbonates

Poly carbonates have an outstanding combination of high impact strength, high temperature resistance and clarity and can stand repeated heat sterilization. Hence they are very successfully used as re-usable containers like feeding bottles for infants.

Multilayer materials

The flexible packaging materials manufacturers generally combine the many different materials into a composite structure. Aluminium foils of various thickness are the best suited materials for providing the protection against moisture, oxygen and flavor. Aluminium foil readily combines with any of the other materials to meet specific end use requirements. Usually aluminium foil is combined with paper or polyester on the outer side and a heat sealable layer like polyethylene or polypropylene on the inner side. This multilayer combination has played a very crucial role in developing the flexible packaging for various Defence and Civilian application.

Work carried out at DERL Mysore

DFRL, Mysore has done extensive and pioneering work in developing flexible packaging systems for different types of food based on the above materials. For freeze dried and conventionally dehydrated foods, a number of packaging systems based on paper/Al.foil/polyethene has been successfully designed and developed.

For retort processing of Indian food packs based on indigenously available polypropylenes and coextruded have been found to be suitable for Indian conditions and scale of manufacture.

For preservation of breads and other Intermediate Moisture (IM) foods, a simple technique of fungistatic wrapper has been standardised.

Since packaging has been dynamic as stated earlier continuous R & D efforts are necessary for feeding the increasing population and for preserving the food.

Packing of Non-dairy Sweets for Local Markets and Export

K.R. Kumar *

Introduction

Many sweetmeats, based on milk and other ingredients such as cereals and legumes along with sugars and adjuvants are special culinary preparations exclusive to our country. They have an important place in the Indian dietary as snack foods consumed between the two major meals and also included in them. Developments in the proper technology for production on a large scale and appropriate packaging methods would enhance the export market as well as growth of this trade into an industry and infuse a certain amount of confidence.

Indian sweets may be broadly classified into:

Mewa or Monda

These refer to Mawa or Khoa and hence includes preparations using milk or its products as the principal item in their recipes. Thus, Peda, Burfi, Rasagulla, Sandesh are Mewa sweets.

Mithai Sweets

These refer to preparations in which the principal ingredients are sugar and a cereal or legume.

Further, Mithai Sweets can be divided into groups:

- Cereal based : Besan, Rava (semolina) balls, Potarekhu, Sohanhalwa
- Legume based : Sohan papri, Ladoo, Mysorepak
- Nut based : Groundnut and cashew chiki
- Oilseed based : Revadi, Chigli

The product characteristics relevant to packaging of Indian sweetmeats are:

Physical Changes

- Change in colour - darkening bleaching.
- Fat blooming - deposition of fat on the surface.
- Absorption of water vapour - softening or caking at the surface.
- Loss of moisture - drying out at the surface.
- Crystallization of sugar on the surface.

Chemical Changes

- Development of hydrolytic rancidity
- Development of rancidity due to fat oxidation. Products which contain high proportions of fat usually develop rancidity ascribable to certain chemical changes in the fat component after some time. All sweetmeats, since they contain high amounts of fat are liable to become rancid, those containing high

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moisture and high fat are liable to spoil even earlier.

Microbiological Changes

- Packaging of most of the sweets as practiced at present is in paper-board cartons or tin plate containers under non-sterile conditions. This may lead to microbial contamination of such foods. Another source of contamination is through sugar used for the preparation of syrup.

PACKAGE FORMS

Unit Packages

- Flexible Packages,
- Semi-rigid containers, and
- Rigid containers.

Flexible Packages

Pouches of styles - Flat, pillow-type, gussetted and stand up made from monofilms, papers, laminates and composite structures. Polyolefins comprising, low density polyethylene (LDPE), Linear LDPE (LLDPE), High-density polyethylene (HDPE) and High molecular weight HDPE (HM HDPE), cast polypropylene (CPP or un-oriented) and biaxially oriented PP (BOPP), are used extensively for packaging foodstuffs which are predominantly sensitive to moisture changes. In general, they are good barriers to water vapour and provide good heat-seals impact strength and chemical resistance.

HDPE has better barrier properties by a factor of 3-5 over LDPE, but is more translucent. It also requires a higher temperature for sealing.

PP has better clarity and grease-resistance than PE, but requires rigorous control of temperature for sealing. Heat-sealable BOPP and pearlized PP are being increasingly used due to better protective functions and appearance.

All the polyolefins have high permeabilities to oxygen and aromas and are not very resistant to seepage of fats and oils.

Cellophanes, being regenerated cellulose films with either nitro cellulose coatings (MST or MSAT) or poly vinylidene chloride copolymer (Saran) coatings (MXXT) have good protective properties. The latter type of cellophane is claimed to possess good water-vapour, gas and aroma barrier properties and grease resistance. In the current context of accent on biodegradable materials, cellophanes will be more suitable than others.

Polyester (Polyethylene terephthalate or PET) and polyamide (PA or Nylon-6) films possess good barrier properties towards oxygen and aromas but unsupported does not give suitable seals. Hence they are combined with other plastic to provide this function.

Among the papers, grease-proof and glassine are important for sweets packaging, as these provide grease resistance and aroma barrier properties. Glassine which is super calendered grease-proof paper possess better functional properties.

Laminates, which are combination of two or more individual films comprising papers, plastics, metallized films and aluminium foils can be tailor-made to meet any requirement. The selection of any material combination depends on the functional properties required, the distribution area and the shelf life sought.

Some of the common laminates used are glassine/PE, cellophane/PE, plain or metalized polyester/PE, paper/foil/PE and PET/FOIL/PE.

More recently coextruded films, that is various plastics extruded together in a single machine have entered the packaging field. A common structure of an outer PE layer providing water-vapour barrier, "core" layer of polyamide providing oxygen and aroma protection with an inner layer of PE or Ionomer can be used to package sweetmeats. If an oil-resistant film which would run well on machine is required, the inner most web could be of ethylene-acrylic acid copolymer (Primacor).

To enhance the shelf life of the products, either vacuum packaging or gas packaging can be resorted to. Vacuum packaging is suitable for packing sweets having more rigid structure such as Sohan Papdi and Mysorepak, while gas packaging is better suited to products such as nut-based sweetmeats. For these applications,

composite materials such as PET/PE, Metallized PET/PE, PA-based coextruded films and foil-laminates can be used.

Semi-Rigid Packages

Folding cartons and set-up boxes, Thermoformed containers and Bag-in-box systems.

- Thermoformed containers

  Blister packs, single and multi-cavity trays, thin wall containers are some of the packages called as thermoformed packaging containers. These are produced by the process of thermoforming, either vacuum, pressure or matched-die methods.

  For packing sweets, thermoformed trays are more suitable. For multi-cavity trays, the number, shape and size of cavities is determined by the product to be packed. Such trays are useful when a number of similar or assorted items have to be packed to make a complete set. The shape of the cavities can be designed to match the contours of the product and hence the chances of breakage or damage by mutual collision of products is minimised. Further, by adding a lid, the trays can be used as display packs.

  The commonly used materials for thermoformed containers are PVC, polystyrene, HDPE, PE in gauges of 0.15-0.5 mm. More recently co-extruded sheets of materials with different physico-chemical properties have been developed to get economical packs with optimum properties.

  Another thermoformed container material is expanded polystyrene, which has high cushioning property. The very low bulk density of EPS allows to produce containers economically.

- Lined folding cartons

  This is a system of bag-in-box (Cekatainer Rollatainer or Hermetet) where an inner pouch is lined to the outer paper-board carton. The selection of liner material is decided by the functions required, the common materials being paper/PE plain or metallized PET/PE, paper/foil/PE and even PET/Foil/PE.

  Manual, semi-automatic or fully-automatic carton erecting and filling systems are available to pack varieties of products.

Rigid Packaging Systems

- Metal containers

  The conventional OTS cans of tin-plate available in various standard sizes are used to package varieties of sweetmeats. If inert gas flushing is required, tagger-top cans are preferable. For flat products, 3-oz Dingley cans are preferred. Newer metal containers include electrolytically tin-coated cans, impact-extruded aluminium containers and chromium coated (tin-free-steel) cans.

  Built up aluminium containers are available in circular, oval, rectangular or any fancy shapes and can be decorated in an unlimited range of design and colour variations. The top ends may be of ring-pull type for easy opening.

- Composite containers

  These are made of fibre-board bodies and metal or plastic ends. The container body construction can be either specially wound or convoluterly wound with paper-board having aluminium foil and/or plastic liners. The top end can be fitted with ring-pull closures or other types including those with reclosure facility.

  The composite container having a body of 25 um PE/paper board/0.009 mm foil/37 um LDPE with a WVTR of 0.003 g/24 hrs at 38°C and 90% RH is available to package sweetmeats.

Shipping Containers

Corrugated fibre-board boxes (CFB) are being employed as exterior containers for packing unit packs, both for inland and export markets. They can be used upto a maximum weight of contents upto 75 kg. The BIS specifies that the boxes shall be manufactured according to the style and design

as agreed to between the purchaser and the suplier. Various styles of fibre-board boxes suitable are;

Regular slotted container (RSC)

This is also called as universal slotted container. In this style, all the flaps are of same length and outer flaps meet at the centre. This is simple to manufacture and suitable for most applications and hence nearly three-fourths of CFB are in this style.

Centre special slotted container (CSSC)

In this style, both inner and outer flaps meet at the outer. Although this consumes more material, they provided added protective function.

Full overlap slotted container (FOL)

In this, only the outer flaps have full overlap and the inner and outer flaps are of same length. These CFB boxes have better resistance to rough-handling and possess good compression strength and provide extra cushioning.

Bliss box

These have considerable stacking strength and are suitable for bulk packaging.

The above types of CFB boxes are shown in the figure below.

The requirements of CFB boxes to container unit packages are indicated in Table 1.

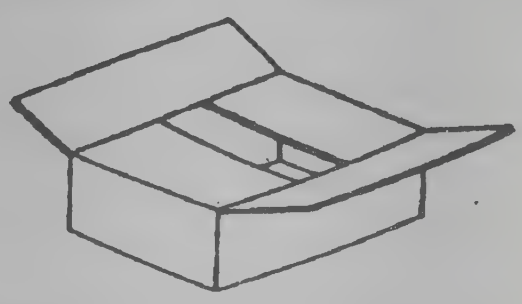
The BIS further indicates that the

- Boxes shall be made with no single dimension exceeding 50 percent of the sum of the permitted combined dimensions (L+W+D);
- For each 10% reduction in mass of contents below the maximum permitted for a case of combined dimensions shown in the table may be increased by 5%;
- If a box is required for export or special use, it may be advisable to equate the board details given in the table to a reduced mass of content or reduced maximum dimensions.

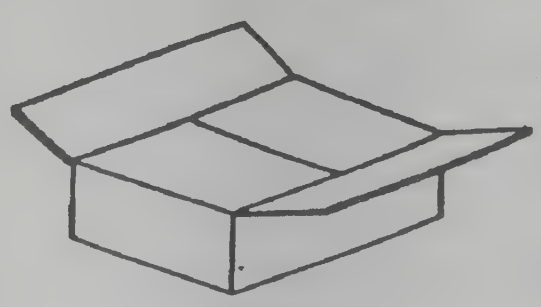
The manufacturers joint may be either lap or butt joint and may be stitched or glued. The water absorption of the outer surface of the CFB box maximum limit is 155 g/m2 (Cobb value) for 30 minutes test.

Others

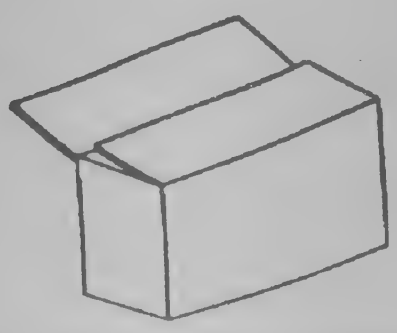
For bulk storage, lined hessian sacks, plastic woven sacks and rigid containers such as paper-board drums, plastic bins and plastic corrugated boxes can be used.



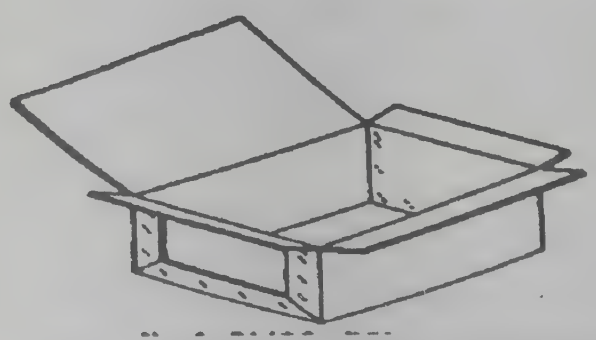
REGULAR SLOTTED CONTAINER (RSC)



BLISS BOX



FULL OVERLAP SLOTTED CONTAINER (FOL)



FULL OVERLAP SLOTTED CONTAINER (FOL)

Table 1 Container Boards and their strengths

Type of board	Maximum mass of contents, Kg	Maximum combined internat-ional dimensions (L+W+D) 1, mm	Minimum bursting strength of the board			Combined liners gram age
			Kgf/cm2	PSI	KPa	
Single Wall and (3-ply)	5	635	6	85.3	588	300
	8	750	8	113.8	784	300
Double Wall (5-ply)	10	1025	10	142.2	980	300
	15	1275	12	170.6	1176	360
	20	1525	13	184.9	1275	400
	30	1650	15	213.3	1471	–
	40	1775	21	298.6	2059	–
Double Wall (5-ply) and	15	1275	9	128.0	852	–
	20	1525	10	142.2	980	–
	30	1650	14	199.1	1373	540
Triple Wall (7-ply)	40	1775	17	241.7	1667	850
	55	1900	24	341.3	2353	1100
	75	2150	29	412.4	2843	1200

PACKAGING AND STORAGE STUDIES

Sohan Halwa

Normally, this will have a short shelf life of about 15-20 days under the normal conditions. To extend the storage life, Sohan Halwa treated with BHA and packed separately in flexible pouches (paper/foil/polyethylene, HDPE and LDPE) and rigid container (tagger top tin can) and stored at 27° C and 65% RH upto a period of 180 and 300 days respectively. The moisture sorption studies revealed that the product had a permissible moisture pickup of 1.7% with a critical moisture content of 3.0% and ERH of 25%. Chemical parameters such as FFA and PV were periodically estimated. Sensory evaluation indicated that the product could not be stored even for 30 days in LDPE at ambient conditions, while it can be stored for 120 days and 180 days in HDPE and foil-laminate pouches respectively and 30 days in tagger-top cans.

Sohan Papdi

This sweetmeat based on besan has a short shelf life of about 12 days. In order to extend the shelf life, Sohan Papdi was treated with BHA and packed separately in flexible pouches (foil laminate, HDPE and PET/LDPE) and rigid containers (Dingley and tagger top) and stored at 27°C and 65% RH upto a period of 110 and 225 days respectively. The moisture sorption studies revealed that the product had a permissible moisture pickup of 1.7% with critical moisture content of 3.0% and ERH of 30%. Chemical parameters such as FFA, PV, Kreis test, TBA and colour were periodically estimated. Sensory evaluation results indicated that the product could be stored well for 30 days in PET/PE, 110 days in HDPE and aluminium foil laminate and 225 days in rigid containers.

Snack Foods

Packaging and storage studies have been carried out on fried moong dhal, black gram and green gram wadean, phul wadian and mukund wadian, mixed namkeen, dal moth, khara bundi and fried potato and banana chips, roasted, salted peanut and cashew kernels.

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India as a Market for Processed Foods

Paul Mathew

The Indian processed foods market was worth Rs.100 billion in 1991 — and this excludes low value added products such as liquid milk and unrefined vegetable oils. This market is made up of more than 200 brands across more than 45 products which, in turn, can be grouped into 10 distinct categories: dairy products, oils and fats, bakery products, processed fruits and vegetables, hot beverages, cold beverages, Indian foods, Western foods, confectionery and frozen foods.

This market of Rs.100 billion represents the output of what is called the organised sector. Strictly speaking, the organised sector is made up of manufacturing units who, by virtue of their size, have had to obtain a license to manufacture. Excluded, thus, are the host of "tiny" organisations who market unbranded products or who are limited to one town or state. Such tiny organisations are active or, in some cases, dominant in the market for products such as cheese, ice cream, jam, papads, pickles, bread, spices, sweets, confectionery, biscuits, snack foods and pasta products. Also a number of products are sold loose rather than packed: including tea, coffee and spices. These, too, have been excluded from the Rs.100 billion estimate.

How much does this exclude? This is really anybody's guess but it is certainly very much larger than the total output of the processed food industry. Estimates vary from Rs.750 billion to Rs.1250 billion but in noting this we might well be guilty of using the word "estimate" very loosely.

Is there an underlying set of factors that determine why the unorganised sector plays a substantial role in some products and is virtually non-existent in others? There are four possible reasons for this:

Distribution Limitations of the Organised Sector

For the organised sector to find a territory attractive enough, it must be large enough to be profitably exploited by the conventional distribution system. This is often not possible for products such as ice creams (with their requirements of refrigerated transportation) or for high volume products like potato chips or for products where the purchase cycle is short like bread or liquid milk. Consequently, the organised sector is often not present in a number of small towns. The resultant vacuum is filled by the unorganised sector.

The "Standard" taste of organised sector output

By definition, almost, the organised sector treats the entire country as one market and offers products accordingly. Thus, a spice manufacturer like Brooke Bond offers only one version of its all-purpose spice blend "garam masala", for sale in North India and in South India — disregarding the fact that tastes, preferences and food habits are very different in North India and in South India. The result of this is that a small cosmopolitan minority does buy the Brooke Bond garam masala all over the country but local variants outsell a "national" brand like Sona in a given market. This factor has resulted in the dominance of the

unorganised sector in products such as papads, and pickles besides spices.

Pricing

Due to low volumes in the organised sector and the impact of excise duty, as well as, at times, the high costs of packaging, it sometimes happens that organised sector output could cost two to three times what unorganised sector output costs. This is especially true for products such as snack foods and potato chips.

Product Range

Unorganised manufacturers can often offer a range that organised sector manufacturers cannot — or do not. Thus, an army of small bakeries produce a range of biscuits and cookies that the large manufacturers do not. Similarly, small manufacturers of jam and jellies offer a range that goes far beyond the ubiquitous "mixed fruit jam" of the large manufacturers.

For reasons such as this, the unorganised sector remains a dynamic and vibrant component of the processed food industry. However, data on the production of this sector is hard to come by and, short of basing estimates on extremely detailed primary field work, inaccurate.

The organised sector itself, presents a fascinating mosaic of successes and failures.

- Some products, by virtue of being truly essential, have carved out huge markets for themselves; the vanaspati market was worth Rs.3 billion in 1991; the branded tea market was worth Rs.10 billion the branded ghee market was worth Rs.6 billion.
- her products like bottled soft drinks, beer and biscuits began as products alien to the Indian market; slowly, over the years they established themselves in the Indian market and now command large markets. In 1991, the beer market was worth Rs.7.25 billion, the soft drink market was worth Rs.7.20 billion and the organised sector biscuit industry was worth Rs.6.20 billion.
- Some products, initially alien but present in the Indian market for more than a couple of decades, have only been able to establish relatively small markets: the Rs.400 million jam market, the Rs.140 crore dessert mix market and the Rs.80 million breakfast cereal market are all examples of this.
- Some so-called Indian products have been around for a number of years but have been unable to establish sizeable markets: the branded packed spice market was worth all of Rs.520 million while the ready mix market (idli mix, gulab jamun mix etc) was worth Rs.300 million in 1992.

Indian Sweets Industry

The Indian Sweets Industry is unique in the sense that it is dominated by the unorganised sector. A very large variety of sweets is sold in India manufactured by a battery of small shops called Halwais with retailing taking place at the same location.

According to estimates, annually 3.06 million tonnes of milk is converted to khoa which in turn is used to make sweets. This translates to a mammoth market for milk based sweets valued at Rs.3800 crores. In this industry, one-shop outlets are the most popular with almost all being family owned.

Refrigeration is of vital importance in this industry as the shelf life of sweets is very short. Sufficient inputs have not been made as yet in Research and Development to stretch shelf life and to retain taste and flavour. This, of course, has impeded distribution. A characteristic of this industry is that most production takes place under extremely unhygenic conditions, a factor which is ignored by the end consumer.

The organised sector has a miniscule presence in this vast market. Some examples:

- Dalmia Dairies made a foray into the vastly popular segment of rasagullas. Their brand Sapan bombed due to a host of reasons.
- Their claim on hygiene was ignored by the consumer
  - ➥ Their pricing was prohibitive i.e., Rs.33 for 20 rasagullas at a weight of 1 kg
  - ➥ The standard pack size of 1 kg put it virtually out of reach for the common man who could buy lesser quantities at cheaper prices from the local halwai.

- Sapan had a rubbery texture and too high a sugar content. This level of sugar was needed to preserve the product and contributes to the high price. The rubbery texture as well as the price failed to generate repeat purchases.

- K.C. Das, a well known manufacturer of rasagullas has outlets in Bangalore, Calcutta and Bombay. Limited distribution is done in other select cities. K.C. Das rasagullas are available in packs of 500 gm and 1 kg, loose as well as tinned. Sales in 1991 was a miniscule 150 tonnes valued at Rs.90 lakhs. With expansion still taking place, K.C. Das might be the first truly national brand in Indian sweets.

- The single most important marketing success for the organised sector was the entry of Warana and Amul in the branded shrikand market. Given the fact that the shrikand market is almost entirely restricted to the West zone, sales in 1991 were an amazing Rs.16 crores. Over 90% of this was sold in Bombay alone. An important factor which should be kept in mind is that advertising is minimal, being restricted to press and the relatively heavy use of hoardings.

The issues at present for the marketing success of anyone seeking to enter the branded sweets market are:

- Sufficient investment in research and development to tackle the problems of mass manufacture, increasing shelf life and at the same time retaining taste and flavour.
- Pricing is critical. Prices should be competitive with the halwais.
- Taste must be standardised so as to equal that of the halwai.
- The Indian consumer perceives refrigerated items as stale. Investment in educating the consumer against this notion will undoubtedly pay off in the long run.
- Sufficient advertising must be done to generate interest and initial purchases.
- Lastly the hygiene factor would also work if it were regularly hammered into the consumer.

Reference Material : Technical Articles

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on 9th & 10th December 1983

Role of Indigenous Dairy Products in Improving the Economic Working of City Dairy Plants

A.K. Ray Chaudhuri

Introduction

A study of performance of city dairy plants will reveal that many of them are not economically viable. Improvement in the economic functioning of such dairies is highly desirable. One such step towards this end is to take up high profit margin products along with low margin liquid milk supply as a price product mix. However, if the lack of economic viability is due to inefficient management, long and remote chain of control and irrational pricing policy, no improvement is likely to take place even by introducing high margin milk based products. Under such a situation the chances are that such dairies will be burdened with further liability in the form of unutilised capacity or idle machinery and unutilised manpower. Many city dairies suffer from lack of adequate quantity of raw milk to maintain regular supplies. Such shortfall in procurement in most cases is the result of lack of proper planning and incorrect pricing policy. In such cases, taking up milk based products becomes superfluous since, it is most unlikely that the authorities concerned would like to share the limited quantity or raw milk for the purpose of product manufacture. Before thinking of introducing milk product line for the purpose of improving the economic status, the dairies must adopt a rational pricing policy, professionalism in management and responsible management policies to remove the basic weakness of the organisation. The possibility of improving the financial performance of city dairies or any dairy, by introducing high margin milk based products will be applicable only to efficiently managed dairies.

Pattern of milk utilisation:

A look at the pattern of milk utilisation in the country during the forties and gradual but significant changes that took place over the decades will reveal certain interesting features. In 1943, 28% of the total milk produced in the country was marketed in the liquid form and 72% was in the product form. Ghee alone accounted for 57% of the total milk production. In 1966, the portion of milk marketed in the liquid form rose to 44.5%, the product manufacture declined to 55.5% and Ghee manufacture declined to 32.7% of the total milk production. The reason for large portion of milk being used for products and mostly indigenous milk products was the lack of facilities to process, preserve and transport a perishable commodity like milk over long distance connecting rural producing centres with urban consuming centres. The utilisation picture changed with improvement in the facility for handling milk in the liquid form. Today, in 1983, there has been further improvement in such facilities and the pattern of utilisation has changed further towards consumption in the liquid form. This change has been more pronounced in recent years, since in addition to improving the geographical balance between the supply and demand of milk; setting up of a large number of Feeder/Balancing dairies is also helping in balancing the seasonal supply and demand.

*Former Managing Director I.D.C. President, Indian Dairy Associa tion, New Delhi

Although recent figures for milk utilisation are not available, the chances are that larger portion of the milk produced in the country is being utilised in the liquid form and smaller portion going in for product purposes. Even within the milk product sector, the decline is likely to be more pronounced in ghee production. The following table (Table 1) will reveal what is happening if percentage figures are converted into absolute figures on the basis of reported total milk production in the country.

TABLE 1 Quantity of milk used for liquid consumption and for product purposes in 1943, 1966 and 1982.

Million Tonnes

Year	quantity of milk produced	quantity used as beaverage	quantity used for product	quantity used for ghee	quantity for other products
1943	16.61	4.65	11.96	9.47	2.49
1966	20.70	11.49	10.22	6.76	3.46
1982	32.00	14.24*	17.76*	7.36*	10.40*

* Figures for 1982 are based on 1966 pattern of utilisation as published figures for milk utilisation in 1983 are not available. In 1982 percentage of liquid milk utilisation will be more than that of 1966 and therefore percentage of use for milk product will be less.

With further improvement in liquid milk handling facilities, the proportion of milk utilised for ghee production and actual quantity of ghee produced will decline. It will probably be a welcome trend for Indian dairying since manufacture of ghee does not give adequate return. In Western world, animal fats like lard and tallow constitute the principal cooking medium. In our country, as dairying will develop the population will have to depend more and more on vegetable oil for cooking purposes. This trend will continue until demand for ghee from affluent section of the population will raise the ghee prices so much that the return from ghee will be remunerative in comparison to other modes, of utilisation. The chances are, however, that there will be more demand for milk products other than ghee and conserved products which can be reconstituted into milk. This situation is likely to be helpful for development for dairying.

Organised dairies and Western milk products:

When modern dairying came to India it came from the Western World. It came with western technology, western dairy machines and western system. The technology suitable for machine handling of milk products was for western products like infant milk food, condensed milk, dry milk powder, cheese and table butter. The so-called organised dairies took up these products, as technology and machinery were available and a market demand was already created through imports. These products were found to be more lucrative than marketing of liquid milk and most of the private investments were for establishment of dairies for manufacture of western type of milk products. The most successful co-operative venture in the country, the Amul dairy organisation, originally depended on liquid milk supply to Greater Bombay Milk Supply Scheme but gradually diversified into products and that also western type of products, as the organisation found that it had generated more milk than the Greater Bombay Milk Supply could absorb. Another reason for diversification may be the desire to develop an alternative channel for marketing independent of the GBMSS. This is a very good example of the role of dairy products in improving the economic functioning of a dairy. Amul Dairy is really a feeder/balancing dairy but similar principle will apply in case of a city dairy and with indigenous dairy products if certain conditions are fulfilled. The success of Amul is due to high degree of professionalism and efficiency in planning and management which are yet to be achieved in many dairy organisations in the public, private and co-operative sector. With the establishment of a large number of Amul type organisations in the country and improvement in the functioning and management, a time is likely to come, when there may be too much production of western type dairy products to maintain a remunerative price line. To counter that situation, in future, attention should be given to indigenous products, particularly high margin products so that these can be taken up by organised dairies on a large scale.

Organised dairies and indigenous dairy products:

As already indicated before, the organised dairies are functioning with western type dairy equipment and western technology which cannot be used as such for manufacture of indigenous milk products. True, some attention has been given to ghee production and organised dairies have also taken up ghee production and organised dairies have also taken up ghee production, though ghee is not the most lucrative indigenous product line. This is due to the fact that butter fat sometimes becomes surplus in factories manufacturing skim milk powder and all factories have to handle sour milk particularly during summer. Sour milk or return milk is sometimes used in dahi production in some urban dairies but that is only as a by-product and the quantity is small.

The most profitable indigenous milk products cannot be taken up on a factory scale because of lack of process and packing technology and suitable equipment. The National Dairy Research Institute has given attention to some indigenous products and have come out with such products as cooking paneer, shrikhand powder, dried channa and dahi powder. It also devised a machine for continuous khoa making. These products could not be manufactured on a factory scale nor it appears that these have been tested in large sized pilot plants. The CFTRI, Mysore recently came out with instant dahi powder to make home production of dahi easy and quick. This product also does not appear to have been tested on a factory scale. Attempt by the NDDB to manufacture milk sweets on a factory level production has succeded. The first product that has been taken up is Shrikhand, one of the most popular sweetmeats in Western India. Initially studies were made in the laboratory and then tested at Baroda with the co-operation of Baroda Dairy. Available equipment were brought in and with suitable modification the process line was set up. When successful production was possible on a factory scale, the services of professional marketing agencies were utilised to launch the product. The uniformity of the product, hygeinic packing and the taste and the flavour suiting the consumers, the product became extremely popular in a short time. This Shrikhand, under the brand name 'SUGAM' was so much in demand that there was need for expansion in production. Anticipating the potential of the project, a separate dairy called SUGAM Dairy was established within the Baroda Dairy premises. Assistance was provided by the Government, and the IDC under the Operation Flood. In 1982-83, as the Annual Report reveals, nearly eight years after the product was tried on a laboratory scale, the Sugam dairy became a profitable organisation and produced 918 M.T. of Shrikhand. The target for 1983-84 is 1510 M.T. In 1981, the Sugam Dairy also launched Gulabjamun and during 1982-83 produced 94 M.T. of Gulabjamun. The Gulabjamun line can produce 3000 balls per hour and the target for 1983-84 is 100 M.T. During processing, packing and retailing, strict quality measures are enforced thereby creating customer confidence in no uncertain manner.

The Sugam Shrikand and Sugam Gulabjamun project has been described more than other projects, partly because these projects have been successful and partly to indicate the need for a systematic approach. The laboratory research is to be followed by development of process technology to suit available machines and the manufacturing process is to be tested on a pilot scale for market study such as consumer preference and consumer acceptance. Launching of the product is to be done professionally and quality control should be enforced rigidly at every stage. Introduction of indigenous products into modern dairies on the basis of cottage industry scale technology, as practiced by small scale confectioners, will not be able to provide expected economic advantage and since the product will not likely be competitive qualitywise or pricewise.

Survey of indigenous dairy products:

Although a variety of indigenous milk based products, some of which are highly priced and fall in the category of delicacies, are in existence throughout the ages, no proper survey report as to the origin, composition, method of manufacture and production figures exists in the country. Even a survey on a regional basis will be of great help for the organised dairy sector to enter into the

CLASSIFICATION OF INDIGENOUS MILK SWEETS IN EASTERN INDIA.

Channa Based :-

Pure channa with sugar

Cooked Channa - Juicy products	– Rajbhog-stuffed with khoa or spices or nut-meg and boiled in thick caramelised sugar syrup.
	– Danadar :- Boiled in very thick almost crystaline sugary syrup.
	– Chamcham :- Boiled in thick sugar syrup and sometimes coated with khoa powder;
	– Rosogolla :- Boiled in thin syrup.
Uncooked channa	– Katcha golla.
Cooked Channa - dry Products	– Sandesh - medium moisture content.
	– Kara pak sandesh - very low moisture content.
Fried channa pieces coated with sugar	– Chanar murki
Channa mixed with coconut mince	– Narkel sandesh.
Channa mixed with flour and/khoa	– Dry product - mixed sandesh
Juicy product	– Golabjam, langcha, kalajam, Pantua, channar jeelabi
Channa dried, drained and smoked and cut into small hard pieces	– Surpi - a product of hill areas
Concentrated Milk Based	– Kheer, Rabri, Rosomalai, Payesh
Fermented milk based	
Sour curd	
Sweet curd	– white curd
	– Brown caramelised curd made from concentrated milk - 'Misti dahi'
Evaporated milk based	– Peda, Gujia, Burfi, Khoa, Sarpuria
Frozen Milk Based	– Kulfi malai

Note

The above is a crude attempt to classify the milk sweets common in Eastern India. There are many more which have not been included above. A variety of names are given to each of these products (except Rosogolla) by altering the shape, size, colour and by mixing with products like Cocoa and by intermixing different milk based sweets. There may be many variations and the list above is not exhaustive.

indigenous dairy product trade. It will help in selection of the product for study, to devise factory scale process technology, marketing strategy and planning.

Indigenous dairy products differ from region to region depending on the climatic condition, food habit of the population and type of raw milk available. An example from Calcutta market will reveal this diversity and the variety of the products which are manufactured even on a cottage industry scale. Many of these products are unknown to people from other parts of the country as people

in the Eastern region know very little of the type and variety of milk based products of other regions. In West Bengal and states adjoining it, the channa based products predominate. People also have developed a taste more for channa based products than khoa based products. The most important milk sweet in this region is Rosgolla and Sandesh. Rosgolla and high quality Sandesh are exclusively made from cow milk and that also from channa prepared by the confectioners themselves. Channa from buffalo milk does not give quality Sandesh and Rosgollas and inferior type of channa even from cow milk is not suitable for these products. There are tracts in rural Bengal where channa is prepared for sale to confectioners through wholesale and retail market for channa. Another popular product-sweet curd or Mishti Dahi-which is brown in colour due to use of caramelised sugar and sometimes added colouring material is more a sweetmeat than a curd. Price of Mishti Dahi goes up to Rs.15/- a kilogram during festival season and rarely goes below Rs.12/- in other seasons. Ordinary curd is sold at a price ranging between Rs.11/- to Rs.14/- a kilogram. Over the last five years, the price of milk based sweets has doubled in Calcutta market although the milk price has not gone up to that extent. When sugar prices increased to Rs.8/- a kilogram, the sweetmeat prices were increased. When the sugar prices came down the sweetmeat prices did not come down. Prices of sweetmeats are fixed by an association of some leading confectioners and all confectioners usually follow the lead. In this lucrative milk based sweetmeat trade, it is the confectioners who gain most. If organised dairies take up successfully and capture even only a size able portion of the lucrative milk sweet trade, the dairies will benefit, the milk producers will benefit if the dairies pass on the increased return to the producers and the consumers will benefit because of uniform and hygienic product. Although general procedures are known, the excellence of the end product depends on the quality of raw milk and skill of the craftsmen. The organised dairies should be able to copy and translate the skill of the craftsmen to machines to win the market over from the traditional sectors.

If in the Eastern region one is required to select products for organised dairies' adoption, the choice should fall up on Rosogolla, Sandesh and Mishti Dahi.

Role of indigenous milk product in stimulating cow milk production:

Emphasis has been placed on cross breeding of cows with exotic breeds to increase milk production rapidly. As at present, the price of milk solids from buffaloes is cheaper than that from cows, the organised dairies naturally prefer buffalo milk. This is inspite of some preferential price fixed for cow milk by some dairies. As a result, cow milk production enhancement will always have a serious impediment for want of remunerative outlet. It has been mentioned that some milk based delicacies such as Rosgolla and good quality Sandesh require exclusively cow milk as the raw material. If organised dairies take up production of Rosgolla and good quality Sandesh, a profitable out let will be opened up for cow milk. Besides West Bengal there are areas in Orissa, Bihar, Rajasthan, Karnataka and Kerala where sizeable amount of cow milk is produced and likely to be produced in larger quantities because of emphasis on cross breeding. It is worthwhile exploring introduction of Rosgolla and Sandesh on factory scale in these regions since the market for these products is spreading to other parts of India. There is also some demand for hygienically produced and packed quality Resgollas abroad.

Conserved milk solids for manufacture of milk products:

To generate confidence and retain a stable share of a consumer market, there should be steady supply of the commodity and therefore a steady supply of the raw material for the product. This applies to milk products the principal raw material for which is milk. As milk production is seasonal, balancing of demand and supply for manufacturing process can be done only if conserved milk solids can be utilised for manufacture of the desired quality of sweets. This is not a novel idea as confectioners for medium and low grade products are already doing this. For this, not only skim milk powder and fat but also khoa, crudely dried milk and even infant milk food are used. What is required, is to go into the process technology to devise means of utilising the standard conserved products for manufacture of quality milk sweets.

Studies are also required for new methods of conservation to suit manufacture of indigenous dairy products. For good quality Rosgollas and Sandesh which require cow milk, attempt should be made to use buffalo milk by altering the physico-chemical properties of buffalo milk casein.

Arguments against use of milk for manufacture of milk products:

Until the middle seventies most of the city dairies were experiencing serious short fall in milk procurement. It was thought that the confectioners and milk product factories by paying very high prices divert milk to make milk products. It was also believed that the urban liquid milk scheme cannot afford to pay very high price for raw milk in competition with the confectioners and milk product manufacturers as that would affect the urban consumers adversely. To mitigate that situation, the concerned Governments used to put a ban on manufacture of milk products and movement of milk during lean season. One of the State Governments also introduced a licensing system so that a limited quantity of milk is permitted for product manufacture. The same State Government also placed a ban on the manufacture of channa based milk products. These restrictions are still continuing in many States in varying degrees. There is doubt where these measures have increased procurement of milk by the urban dairies. There is no doubt that these measures have not helped in increasing milk production. Such legislative and administrative measures are difficult to implement. There are loopholes which the interested parties soon find out and there are means to bypass the law when unscrupulous staff are on the implementing agencies. Since midseventies availability of liquid milk for the urban dairies is on the increase and is likely to increase further with more and more urban dairies adopting better pricing policies and more and more rural dairies coming into production. Although it is now realised that ban on manufacture of products cannot increase the procurement of milk and that the best way to increase production and procurement of milk is to adopt rational pricing and procurement policies, the authorities of urban dairies may have misgivings regarding introduction of indigenous dairy products as an item of production. On the other hand, the urban dairies which are already increasing the procurement of milk, introduction of high margin indigenous milk products as a price product mix will permit the dairies to pay milk producers higher price without affecting the consumers. This will help increasing production and procurement of milk. Thus introduction of indigenous milk products can play a great role in improving the economy of the dairy industry in general and urban dairies in particular.

Summary

Introduction of indigenous dairy product in to the line of products of dairies can improve the quality, maintain uniformity of the product, satisfy consumers so far as hygienic supply is concerned and enter into export market. High margin products along with low margin liquid milk supply as a product mix improves the economic functioning of the dairy organisation thereby enabling it to pay higher procurement price to increase milk production without severely affecting the consumers of liquid milk. To make such a situation a reality, the technology for processing, manufacture and packing should be developed to suit mechanical handling. Equipment should be devised and adapted from other food industries if available, so that indigenous milk products can be handled on a factory scale. Continuity of supply should be maintained and suitable conserved milk solids should be located so that seasonal fluctuations in raw milk availability can be met. Strict quality control measures should be adopted during procuring raw material, processing, manufacturing, packing and marketing. High degree of professionalism will be required to run dairy plants particularly with product line. Economic weakness of a dairy plant, if due to lack of efficiency in management, lack of rational pricing and lack of rational procurement policies cannot be remedied by introduction of indigenous milk based products. The first pre- requisites under those circumstances is to put the house in order. A survey of in digenous milk products, their origin, composition, methods of manufacture and prices is of paramount interest to assess the present status and future prospects. The indigenous milk products, particularly high margin products, can play a very important role in improving the economics of the dairy industry as a whole.

The Rossogolla Story and Other Achievements of K.C. Das Pvt. Ltd.

B.N. Das *

K.C.Das, Private Ltd. was incorporated in the year 1946 as a private limited company in Calcutta and took over all the assets and liabilities of the firm of K.C.Das as a running concern. The firm of K.C.Das was started by the late Shri Krishna Chandra Das, a doyen of the famous house of Rossogolla. He was the only son of the renowned Nobin Chandra Das of Baghbazar, Calcutta, who contrived to serve the unique pleasure to the palate by his momentous inventions of Rossogolla. in 1868.

Besides Rossogolla being a most palatable sweet it is a nutritious food. It will be redundant to explain the merit of Rossogolla to our countrymen but it may not be known to many that it is made exclusively from milk-casein with sugar syrup which makes it an extremely compatible combination and after undergoing the process becomes easy for digestion.

The late Shri K.C.Das opened an establishment for manufacture and sale of sweets in the vicinity of Jorasanko in Calcutta in 1930 with the object of presenting a new delicacy in the name of ROSSOMALAI lest it might lose its importance in face of the popularity that Rossogolla commands. He invented the process of canning Rossogolla without the use of elaborate plant and machinery. Besides this invention, he introduced paper as a medium of packaging the edibles in place of plant leaves then prevalent among all the Indian confectioners in the city. The first introduction of cardboard carton to serve sweetmeat was met with protestations from the customers. The grease-proof paper a novelty at that time was accepted without much protest and since then has become a vogue with all the confectioners in the country.

Later M/s K.C.Das Pvt Ltd., having inherited all the innovations from its predecessor firm, went on developing the manufacturing process to make the products more standardised. The introduction of steam as means of preparing the sweets in place of open fire not only improved the quality of the sweets it provided respite to workers from being roasted in heat of the ovens.

The company made a headway to bring the Indian Sweetmeat Industry to a commercial level. The canned Rossogolla was the first to be exported by the company to the U.K. but while it was gaining popularity there, through favourable comments in the food magazines, the supply had to be cut off suddenly for want of tin cans during the last Sino-Indian conflict and though later revived it had to be completely stopped owing to ban on use of milk for sweets.

In order to take advantage of the market available in the foreign countries and also to cater to the demands within our country, the company decided to open a second unit where cow's milk would be available in plenty and climate favourable for manufacture of their products. After careful

*Church Street, Bangalore.

consideration they have chosen Bangalore to be the ideal place for such a project. Local branch at Bangalore is manufacturing besides Rasgolla other milk based sweets Gulab-jamun, chum chum, sandesh etc., K.C.Das's sweet curd is known for its quality and has very good demand in Bangalore. Since June 1983 sweet yoghurt was introduced by making the product using youghurt cultures viz S. thermophillus and L. bulgaricus. All the products are known for their quality and high standards as strict enforcement of hygiene at all levels of production is practiced. Besides the above all sweets for diabetes patients (special products) are marketed without any extra cost.

Machinery and Equipment for Indigenous Dairy Products

A. Devariya

Indigenous dairy products have a very long tradition in matter of their production methods, ingredients, flavourings, taste, aroma etc., as well as their shelf life aspects. One can observe a large variety of products typical of different regions of our vast country-Sandesh of Bengal, Pedas from Poona, Lassi in Punjab, Srikhand from Gujarat come to our minds readily.

Basically indigenous dairy products fall into two categories. A large variety of products is manufactured by concentration of milk fats and SNF in cow, buffalo or mixed milk. The other category has the distinctly different process of souring/culturing, resulting in co-agulation and curd formation.

Chart I and Chart II represent some of the products falling in the above two categories. The chart also indicates the type of process at various stages of the production cycle. The charts are on following pages.

From these charts one may observe following main process functions supplemented by information on machineries suited for the purpose.

Standardisation/clarification

This process is usually accomplished by the application of centrifugal force to separate lighter and heavier fractions in a liquid - 'WESTFALIA' - and 'ALFALAVAL' are two brand names of centrifugal machines extensively used in dairy industry.

This type of machine is also used for separation of curd in the process of Srikhand manufacture in what is called a 'Quarg' separator and in clarification (purification) of sugar syrup. Age old practice of straining with a cloth bag may also be grouped under this heading.

Concentration

This process helps to achieve removal of moisture and improving solids ratio in the product. Moisture removal can be effected by:

Application of heat through direct heating, roller drier, spray drier, vacuum pans / evaporaters, jacketted steam heated pans, etc.

- Direct fire heated open steel pans have centuries old tradition of having produced best of Khova, Malai, Peda, etc. The typical caramalised flavour and smoked aroma imparted to products cannot be matched by advanced methods of evaporation.
- Other form of evaporation by heating, applicable to indigenous sweets is the vacuum evaporation through falling/raising/recycling film tubular heaters to achieve certain level of concentration (approx 50%) followed by scraped surface vacuum evaporators which could help achieve upto 80% solids concentrations. These methods however cannot impart typical caramalised flavour of Indian Sweets, etc., but they are efficient in terms of energy consumption.
- Jacketted steam heated vessels with efficient sweeping agitators (like a ghee boiler) could also contribute to hygeinic evaporation of

moisture. This method cannot also provide typical flavour of direct fire pan preparations.

Mixing/Kneading

This process essential for homogeneous mixing of ingredients/flavourings is traditionally achieved by hand mixing and kneading methods, which has capacity limitations. Mechanically, ribbon blenders and/or planetory mixers could perform this function well. Jacketed pans in these blenders/mixers could also accelerate hot mixing and also production of processed cheese.

Frying

The process of frying in oil of product is achieved by using a shallow steel pan, exercising care in using an oil which does not impart any undesirable flavour as well as reusing of oil of an earlier batch. Some of the products release compounds which prevent reuse of oil of an earlier batch. In direct heating pans, it is difficult to control frying temperatures. Continuous circulation of hot oil, thermostatically controlled through an indirect heater, improves quality of finished product as well as prevents decomposition/deterioration of oil used. Such continuous indirect oil heaters in frying processes are essential in large scale production of indigenous products.

Packaging

Packing of milk sweets, which are solids, conventionally have not received any attention. However, semifluid products like curd, srikhand, rosogolla etc., have seen use of one way earthern pots. However, even in India packaging has seen extensive advancement in methods and materials. This subject offers so much to discuss, a separate paper would be worthwhile. The good old earthern pots, bottles, tin cans with sweets in syrup, have proved their reliability and utility. It is difficult to see these age old methods going out of use. Economic considerations have much to commend these old methods. However, innovation in packaging of sour products like Srikhand, Curd, etc., is already visible in our country. Availability of systems to pack semifluid products in an 'Aseptic' pack by use of form, fill, seal machine deserves mention.

Product Storage

While most solid milk products as well as products packed in sugar syrup remain in good condition for reasonably long time at room temperatures products like Srikhand, Curd, Yoghurt, Soft Cheese, Malai, Khova etc., call for refrigerated storage and transportation - conventional cold stores, walk-in coolers, display cabinets, ice boxes, refrigerators serve as effective and reliable storage systems. Suitable designing of products containers helps stacking and therefore full use of expensive cold store volume.

CHART I

Indigenous Products Produced by Concentration of Milk Solids

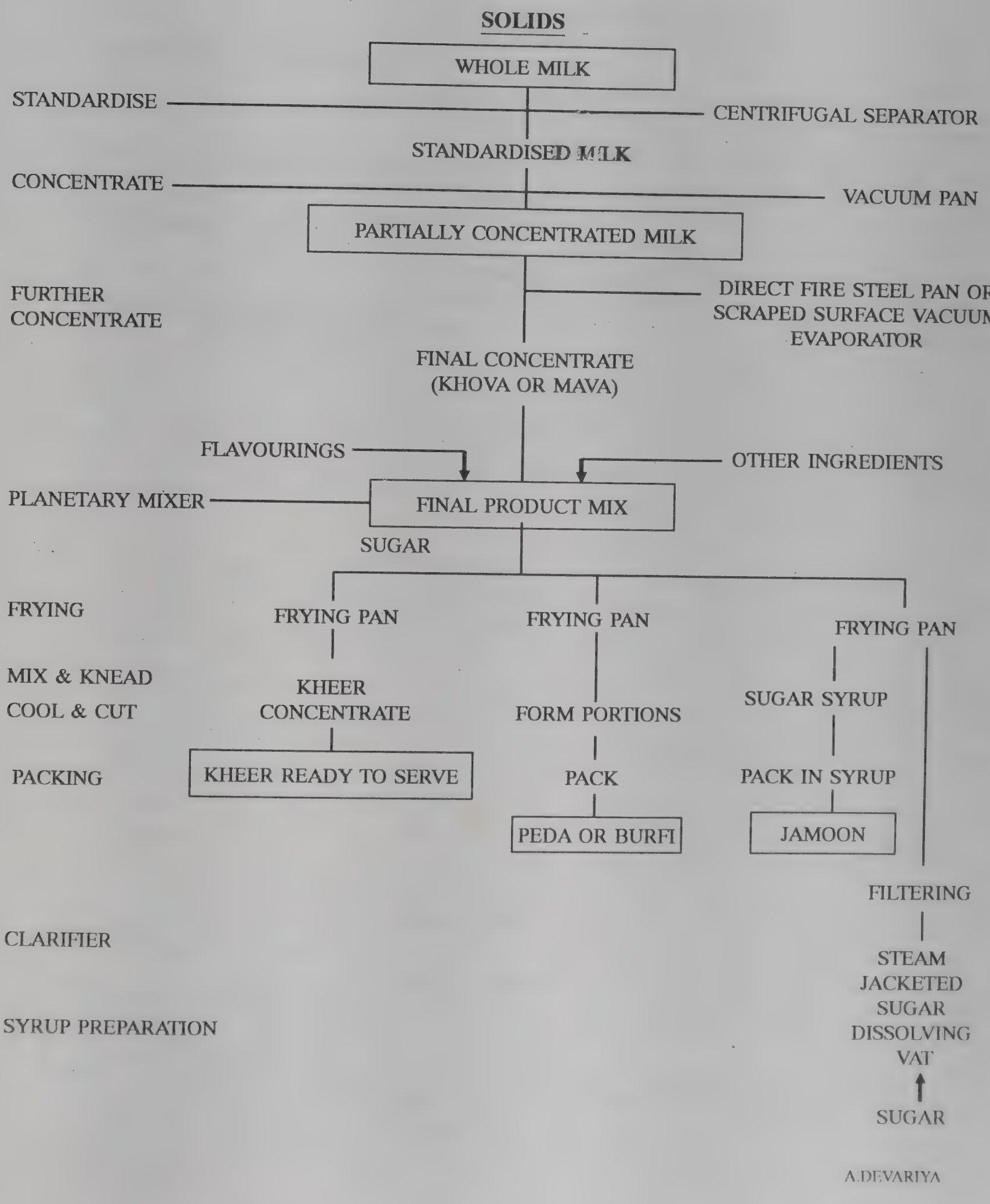

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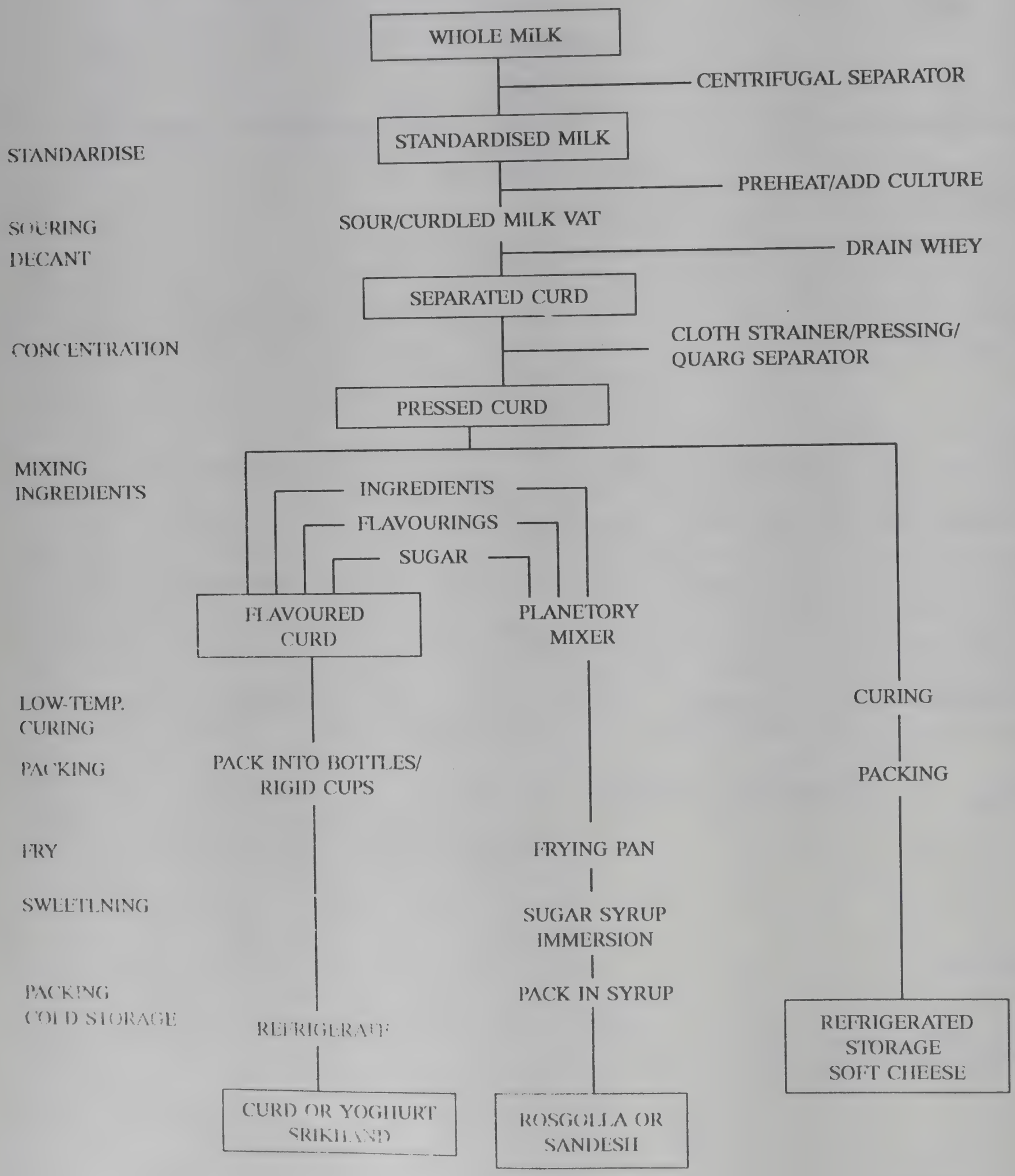
CHART II

Indigenous Products Produced by Souring/Culturing



A.DEVARIYA

Status of Equipment Design for Khoa-Making

S.A.D. Prasad and J.L. Bhanumurthi

Milk based sweets are very popular in India and khoa which constitutes the base and filler for a variety of sweets in the country is one of the most important indigenous milk products. The production of khoa is concentrated in North and Western India since ages and is slowly and firmly making its way in the Southern Region also. It has been estimated that about 7% of the milk used for manufacture of milk products goes into khoa making. A large chunk of the khoa trade even today, remains in the hands of private traders/halwais, active in the vicinity of cities and towns and this can be attributed to the following reasons.

- The technology of conventional khoa making is simple and the investment needed for equipment is within the reach of the tradesman and small scale entrepreneurs.
- Khoa making continues to be an attractive business proposition due to its higher financial returns than fluid milk sales.
- The milk producers take to khoa making as a method of utilising surplus milk in an economic manner.
- Lack of strict enforcement of chemical and bacteriological standards for the product and the capacity of its blending with flour etc., encourages its indiscriminate production.

Many of the organised dairies make khoa based sweets only as a means of utilising surplus milk and sometimes returned milk of high acidity and rally not as a regular high quality product for commercial exploitation. One important reason why khoa making has not yet really come into the fold of the organised sector, apart from shortage of milk supplies, is the non availability of both technology and equipment for large scale production of khoa. Efforts have now started at various R & D centres to fill this gap. Few equipments for large scale production of khoa are already on trial runs and the day may not be far off for the organised sector to take over the bulk of khoa manufacture and marketing.

A brief review of existing stage of equipment design and present status of equipments being developed for khoa making is given below:

The traditional halwai method

Normally 10-15 litres of milk is taken as a batch and boiled in a karahi or pan, usually fabricated from mild steel but of no standard shape, which is placed over a coal fried choola or other heat source. When the milk starts to boil, it is continuously stirred and the pan is vigorously scraped with a long handle khunti or scraper. With progressive evaporation of moisture the milk thickens and at a certain stage heat coagulation of milk protein starts which is indicated by an abrupt change in colour. The heating is continued with careful control and more vigorous scraping until the viscous mass reaches a pasty consistency and begins to dry up. The product is ready when it shows signs of leaving the bottom and sides of the karahi and starts sticking together. The khoa pan is made after removing the karahi from the fire and working the contents with the scraper into a single compact mass.

*S.R.S. of N.D.R.I., Adugodi Post, Bangalore - 560 030

The equipment and the method are simple and advantageous to the tradesman. But the process suffers from certain obvious disadvantages. It is limited to small batches of 10-15 litres for each operation, needs considerable labour for stirring, takes 2 to 2½ house per batch of 10-15 litres, chances of over heating of milk, cooked flavour and taste, caremelisation and contamination by smoke etc., are more.

Steam heated stainless steel Pan

In many organised dairies khoa is made in stainless steel jacketed pans.

Here the karahi and the open fire are replaced by a stainless steel jacketed pan and steam in the jacket as the heating medium. A stainless steel scraper is used to stir and scrape the milk manually. Pans upto 40 litres capacity are available. The procedure for making khoa is same as by the traditional method. This equipment has the advantages of controlled heating by regulation of steam pressure, and a non-smoking heating medium resulting in a better quality khoa. But this equipment still suffers from the disadvantages of a batch process and involves manual stirring.

Recent developments in equipment design

A number of scientists are trying to develop improved equipments for khoa making.

- A continuous khoa making machine

This equipment designed by Banerjee et al (1968) was developed at National Dairy Research Institute, Karnal. A line diagram figure-1 below explains the basic principles.

The milk is partially concentrated in a horizontally mounted jacketed drum heater using steam in the jacket. The milk is further dehydrated in stages in stainless steel jacketed channels of parabolic section. The drum heater and open channels are provided with power driven rotary and reciprocating type scrapers respectively. Successively decreasing steam pressures are used in three stages to control the amount of heat and to prevent burning of milk.

The milk is concentrated to 30-34 percent solids in 10-15 minutes in the drum with a steam pressure of 3 kg/sq.cm. Further in the first stage of the open channel, milk is concentrated to 50-55% solids within 7-8 minutes. In the last stage, a concentration of 70-75% solids is achieved in 6-7 minutes.

The design involves different evaporation rates in the drum heater and the two pan stages, and suitably combining them makes this plant to produce khoa continuously. In the experimental prototype 50 litres of milk per hour can be converted to khoa with a steam and electricity consumption of 50 kgs and 4KWH respectively.

- A village level khoa pan

This equipment suitable for village level khoa-making is designed and fabricated at National Dairy Research Institute, Karnal, (Ishkumar et al, 1981) and makes use of the principles of a pressure cooker type pan. The sketch (figure-2) shows the principles of working of this equipment.

A hemispherical pan with a water jacket has been designed, so that, when placed on a furnace, it can operate under variable steam pressure and temperatures are adjusted by varying the weights on a simple dead weight safety valve which is provided. As the heat from the furnace flows through the water medium, heat flow to milk can be regulated by maintaining the desired water steam pressure in the jacket. A detachable, cylindrical foam column has been devised to increase the capacity of the pan, if necessary. The experimental khoa pan made, was capable of converting 2.5 litres of buffalo milk into khoa in 8 minutes with a final moisture content of 38% (wet basis) in the product when operated at 20 psi water steam pressure in the jacket.

The system adopted for heat regulation is very simple and suits the village conditions. The operator has to simply remove one by one the weights provided on the safety valve, at known intervals of time, to control the heating of milk. The equipment is claimed to have all the advantages of pressure cooker type process such as lesser energy inputs and shorter time of production.

- A semi mechanised equipment for khoa making

The principle parts of this equipment fabricated at National Dairy Research Institute, Bangalore, (G.R.More, 1983) are shown in the sketch, Figure-3.

The equipment consists of a jacketted cylindrical heat exchanger horizontally mounted and steam is used as the heating medium. Milk is introduced from the top through the milk inlet and the scraper shown is rotated either manually or by a geared motor at about 16-20 RPM. The vapours escape from the wide mounted opening at the top which also is the observation window for the product. Trials on the equipment using 6-8 litres of milk show that a satisfactory product can be obtained.

Since the equipment uses a horizontally mounted heat exchanger with steam as a controlled heating medium and mechanised stirrer, a scale up of this design can be used to increase the capacity of the plant to suit the medium scale manufacture of khoa. Further report on this work is awaited.

Conclusion

In view of the many short comings of the present system of khoa production by the halwais or individual traders, there is a need for an organised and large scale production of khoa whether it be in villages or in urban dairies. This will undoubtedly result in a uniform quality product, hygienic conditions of manufacture and an economical cost of production for khoa. To achieve this object, there is a need today to further develop the manufacturing technology, equipment design, storage and packaging methods, to enable economic production of khoa on large scale.

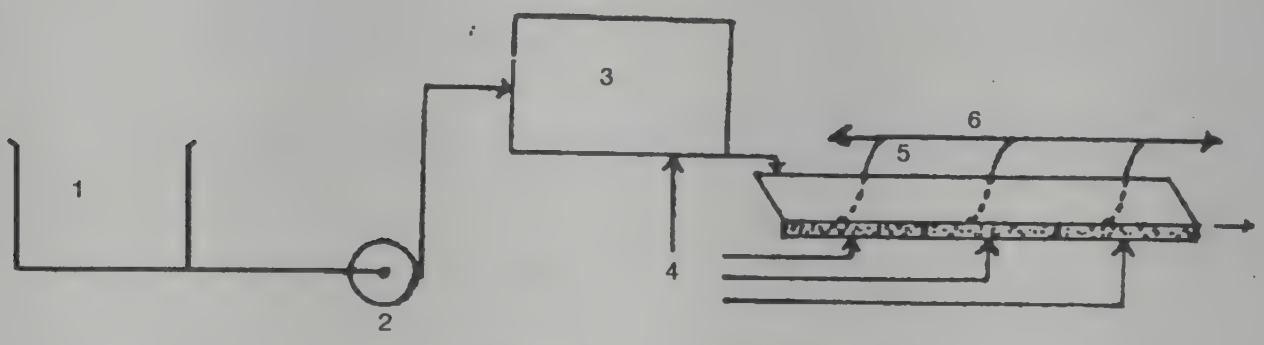


Figure 1

1. Milk Receiving Tank
2. Milk Pump
3. Drum Heater with Scraper
4. Steam
5. Open Pan
6. Scraper Mechanism
7. Steam Jackets

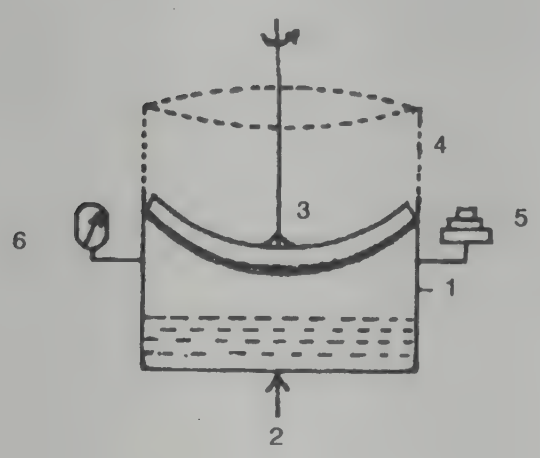


Figure 2

1. Jacketed Pan
2. Hearth
3. Scraper
4. Foam Column
5. Dead Weight Safety Valve
6. Pressure Gauge

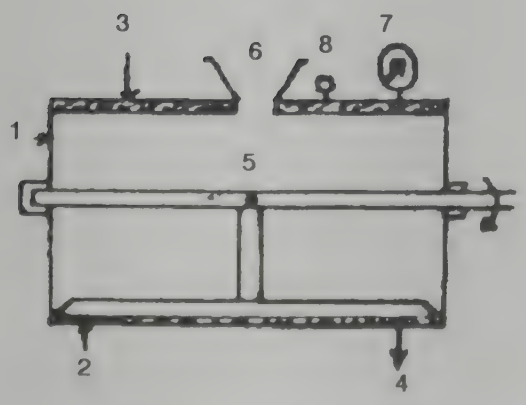


Figure 3

1. Horizontal Drum Heater
2. Stream Jacket
3. Steam Inlet
4. Condensate
5. Scraper Assembly
6. Hopper
7. Pressure Gauge
8. Safety Valve

Diagrams showing equipments for khoa making

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Appendix-1

Standards for Indigenous Milk Products
P.F.A. Standards

	Product	Type of milk	Requirements
1.	Chhana	Cow/Buffalo or mixed	Max. Moisture 70.0% Min. fat on drymatter basis 50.0%
		Skimmed milk, cow or Buffalo or mixed	Max. Moisture 70.0% Min. fat on drymatter basis 18.0%
2.	Khoa	Cow/Buffalo/Goat Sheep, combination thereof	Min. Milk fat 20.0
3.	Dahi	Shall have the same min. percentage of Milk fat and milk solids not fat as the milk from which it is prepared	
4.	Kulfi	Cow/Buffalo or Combination	Min. fat 10.0% Min. Protein 3.5% Min. Total solids 36.0%
		Permitted stabilizers/Emulsifiers	0.5%
		Starch	5.0%

When fruits or nuts of both are added the milk fat can be reduced upto 8% by weight

Appendix-2

ISI Standards for some of the Indigenous Dairy Products

I.	**Burfi IS: 550 - 1970**			**Mawa Burfi**
	i)	Moisture percent by weight - Max.		15.0
	ii)	Milk fat, percent by weight - Min.		12.5
	iii)	Lactose percent by weight - Min.		15.0
	iv)	Succrose percent (by weight) Max.		48.0
	v)	Acidity, percent (lactic acid) Max.		0.35
	vi)	Standard plate count per g Max.		30,000
	vii)	Yeast and Mould count per g Max.		10
II.	**Channa IS: 5162 - 1969**			
	i)	Moisture percent by weight - Max.	—	70
	ii)	Milk fat, percent by weight Max. (on dry basis)	—	50
III.	**Rasogolla - Canned IS: 4079 - 1976**			
		Characteristic		*Requirement*
	i)	Moisture percent by weight - Max.		55.0
	ii)	Fat percent by weight - Min.		5.0
	iii)	Succrose percent by weight - Max.		45.0
	iv)	Protein, percent by weight - Min.		5.0
		Note : All the requirements are on "as is" Syrup		
	i)	Acidity of syrup, ml of N/10 NaoH required to neutralise 100ml of syrup, Max.	—	6.0
	ii)	Concentration of syrup, Max	—	55° 'Brix'
	iii)	Bacterial count per gram. Max.	—	500
	iv)	Coliform count per gram	—	Nil
IV.	**Khoa - IS: 4883 - 1963**			
	i)	Moisture percent by weight - Max.	—	28.0
	ii)	Fat, percent by weight (on dry basis) Min.	—	26.0

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